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REPORT TO CONGRESS

CERTIFIED REGISTERED NURSE ANESTHETISTS

September 1988

Otis R. Bowen, M.D.
SECRETARY OF HEALTH AND HUMAN SERVICES

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EXECUTIVE SUMMARY

This report has been prepared in accordance with Section 2312(d) of the Deficit Reduction Act of 1984, Public Law 98-369, which mandated a "study of possible methods of reimbursement under Title XVIII of the Social Security Act which would not discourage the use of certified registered nurse anesthetists by hospitals." This report has been prepared in conjunction with a cooperative agreement between the Health Care Financing Administration (HCFA) and the Center for Health Economics Research (CHER), Needham, Massachusetts, which was authorized to prepare a study entitled "Payment Options for Non-Physician Nurse Anesthetists."

Key Findings

This report describes anesthesia practice patterns in the U.S., discusses the current role and status of certified registered nurse anesthetists (CRNAs) in the delivery of anesthesia services, and delineates alternative Medicare payment options for CRNAs. Discussions within this report are limited, for the most part, to inpatient hospital services. The key findings contained in the report are:

- While CRNAs currently outnumber anesthesiologists (22,529 to 18,956), the number of anesthesiologists is steadily increasing while the number of CRNAs has leveled off. The increase in anesthesiologists will result in an increase in Medicare's anesthesia payments.

NOTE: On tables and exhibits in this report, MDA refers to Medical Doctor of Anesthesiology.

- The geographic distribution of anesthesia providers varies widely with a concentration of CRNAs in small rural hospitals in the South and Midwest. Anesthesiologists tend to dominate in the West, particularly California.

- Although CRNAs were found to be involved in almost all types of surgical procedures, anesthesiologists tended to be more involved in the most complex procedures and with the most difficult patients.

- A literature review identified no quality issues with regard to the delivery of anesthesia services by CRNAs nor do CRNAs appear to have an adverse impact on physician malpractice insurance premiums.

- While neither continuation of the Part A pass-through for hospital-employed CRNAs nor initiation of direct billing privileges would have any impact upon the current competitive situation of CRNAs in hospitals, the direct billing option may further fragment Medicare's anesthesia payments.

- An anesthesia diagnosis related group (DRG) rate would have the potential to curtail the rise in Medicare costs, but the impact on the competitive position of CRNAs would depend upon the designated recipient of those payments, i.e., the hospital or the anesthesiologist.

Background

The Medicare Prospective Payment System (PPS) dramatically altered the method of paying for anesthesia services performed by CRNAs. Beginning October 1, 1983, the services of CRNAs who were employed by or under contract to a hospital were included in the Medicare Part A DRG payment, while the services of CRNAs employed by physicians continued to be billed under Part B on a reasonable charge basis. Under this arrangement, hospitals faced a strong financial incentive to discontinue employing (or contracting with) CRNAs and to shift the cost of anesthesia to Part B.

Recognizing the incentives the hospitals faced under these provisions, Congress included in the Deficit Reduction Act of 1984 a modification of the mechanism for reimbursing services furnished by CRNAs employed by hospitals. As of October 1, 1984, the cost of CRNA services was removed from the DRG payment and hospitals began to "pass-through" the reasonable cost of CRNA services under Part A, thereby removing the incentive to replace CRNAs with physicians who were allowed to bill under Part B.

The pass-through provision was intended as a temporary measure scheduled to expire on October 1, 1987. However, Section 9320 of the Omnibus Budget Reconciliation Act (OBRA) of 1986 extended the hospital CRNA pass-through provision to January 1, 1989, and allowed for direct fee-for-service billing for CRNA services by CRNAs or their employers thereafter.

CURRENT MEDICARE REIMBURSEMENT PRACTICE

Under current law, anesthesia services are paid under both Part A and Part B of the Medicare program. Part A covers services furnished by nonphysician anesthetists, including CRNAs, who are employed by or independently contracting with a hospital. Payments are made on the basis of reasonable cost principles and are treated as a "pass-through." In other words, payments are separate from the Part A DRG payment under PPS. For calendar year 1986, these Medicare pass-through payments for CRNA services amounted to $69,000,000.

The pass-through provision went into effect in October 1984 in response to concerns that Medicare's PPS provided a disincentive to using CRNAs. When the cost of CRNA services incurred by hospitals was initially included in the Part A DRG payment, hospitals relying strictly upon anesthesiologists and CRNAs employed by anesthesiologists were at a decided financial advantage, and hospitals began dismissing their CRNA employees. (An unknown number of CRNAs were hired directly by anesthesiologists.) The pass-through provision provides a temporary shelter for nonphysician anesthetists from the incentives inherent in the Part A/Part B split in anesthesia services.

Part B reimburses anesthesiologists on a reasonable charge basis for services they furnish. The payment amount depends on whether the anesthesiologist is performing anesthesia alone, supervising a CRNA employed by the anesthesiologist's practice, or supervising a CRNA employed by the hospital. A relative value unit method is used to determine the payment, including base value units corresponding to the complexity of the procedure; time units reflecting the length of the procedure; and modifier units, used at the Medicare carrier's option,

to account for special circumstances such as the patient's age or physical status. The number of units in each category is summed and then multiplied by a conversion factor to determine the reasonable charge. For calendar year 1986, Medicare payments to anesthesiologists for inpatient services were estimated to have been about $750,000,000.

Geographic Distribution of Anesthesia Manpower

In the United States, anesthesia services are primarily provided by physician anesthesiologists, anesthesia residents, and CRNAs. Rough estimates suggest that CRNAs administer at least half of the anesthetics in the U.S.

In 1986, CRNAs outnumbered anesthesiologists 22,529 to 18,956, respectively.* The two professions, however, are increasing at unequal rates. Since 1980, the number of anesthesiologists has risen by nearly a third (30 percent), while the number of CRNAs has increased by less than an eighth (13 percent). These sharp differences are attributable to increasing positions for anesthesia residents and declining training opportunities for nurse anesthesia (Table E-1).

In reviewing the number of CRNAs and anesthesiologists in each State and the rate per 10,000 population, Table E-2 shows that almost 50 percent of the CRNAs in

*These figures are based on membership data from the American Association of Nurse Anesthetists and American Society of Anesthesiologists and exclude student nurse anesthetists and anesthesia residents but include a small proportion of inactive members.

TABLE E-1

NUMBER OF CRNAs AND ANESTHESIOLOGISTS, U.S., 1967-1986

Year	Number of CRNAs*	Number of Anesthesiologists**
1967	13,408	7,864
1968	13,665	8,094
1969	14,053	8,261
1970	14,532	8,668
1971	14,970	9,044
1972	15,525	9,415
1973	15,952	10,022
1974	16,832	10,657
1975	17,167	11,243
1976	17,239	11,871
1977	17,965	12,525
1978	18,856	13,235
1979	19,443	13,894
1980	19,975	14,559
1981	20,377	15,193
1982	21,079	15,936
1983	21,622	16,598
1984	22,312	17,263
1985	22,719	18,067
1986	22,529	18,956

*These figures represent the number of members in the American Association of Nurse Anesthetists, excluding nurse anesthesia students.

**These figures represent the number of members in the American Society of Anesthesiologists, excluding anesthesiology residents.

Sources: Josephine Heimler, Membership Director, American Association of Nurse Anesthetists, Personal Communication, December 1986.

Committee on Manpower, American Society of Anesthesiologists, Annual Report, September 1986.

TABLE E-2

GEOGRAPHIC DISTRIBUTION OF ANESTHESIA PROVIDERS IN THE U.S., 1986

	CRNAs				Anesthesiologists			
	Number***	Percent of Total	Per 10,000 Population**	Rank	Number*	Percent of Total	Per 10,000 Population**	Rank
South Dakota	141	0.7	1.99	1				
North Dakota	129	0.6	1.88	2	31	0.2	0.45****	39.5
Minnesota	774	3.9	1.85	3	272	1.8	0.65****	17
Louisiana	723	3.6	1.61	4	201	1.3	0.45****	39.5
Pennsylvania	1,772	8.8	1.49	5	788	5.1	0.66	15
West Virginia	279	1.4	1.44	6	93	0.6	0.48	37.5
Alabama	562	2.8	1.40	7	170	1.1	0.42	42
North Carolina	863	4.3	1.38	8	273	1.8	0.44	41
Kansas	326	1.6	1.33	9	121	0.8	0.49	36
Tennessee	625	3.1	1.31	10	298	1.9	0.63	20
Delaware	78	0.4	1.25	11	36	0.2	0.58	25.5
Missouri	611	3.0	1.21	12	269	1.8	0.53	33
Nebraska	193	1.0	1.20	13	77	0.5	0.48	37.5
Michigan	992	4.9	1.09	14	486	3.2	0.53	33
Maine	125	0.6	1.07	15	65	0.4	0.56	29
Arkansas	243	1.2	1.03	16	79	0.5	0.34	44
Mississippi	263	1.3	1.01	17	86	0.6	0.33	45.5
Hawaii	104	0.5	0.99	19	67	0.4	0.64	18.5
Idaho	99	0.5	0.99	19	32	0.2	0.32	47
South Carolina	333	1.7	0.99	19	131	0.9	0.39	43
Virginia	525	2.6	0.92	21	306	2.0	0.54	30.5
Georgia	546	2.7	0.91	22	342	2.2	0.57	27.5
Connecticut	287	1.4	0.90	23	267	1.7	0.84	5
Ohio	946	4.7	0.88	24	729	4.8	0.68	12

* Active members in the American Society of Anesthesiology, as of December 31, 1985. These figures will be updated as of December 31, 1986 as soon as the data become available from the ASA.

** Population figures for 1985, from the Bureau of the Census, Boston Regional Office.

*** Active members in the American Association of Nurse Anesthetists as of August 1986.

**** Anesthesiologists in South Dakota are included with the figures for North Dakota or Minnesota. When the revised figures become available from the ASA for December 31, 1986, the members in South Dakota will be

TABLE E-2 (continued)

GEOGRAPHIC DISTRIBUTION OF ANESTHESIOLOGY PROVIDERS IN THE U.S.

	CRNAs				Anesthesiologists			
Totals	Number***	Percent of Total	Per 10,000 Population**	Rank	Number*	Percent of Total	Per 10,000 Population**	Rank
Rhode Island	81	0.4	0.84	25.5	58	0.4	0.60	23.5
Texas	1,382	6.9	0.84	25.5	1,011	6.6	0.62	21
New Hampshire and Vermont	125	0.6	1.20	27	77	0.5	0.50	35
New Mexico	117	0.6	0.81	28.5	82	0.5	0.57	27.5
Kentucky	301	1.5	0.81	28.5	201	1.3	0.54	30.5
Massachusetts	456	2.3	0.78	30	565	3.7	0.97	1
Florida	860	4.3	0.76	31	758	4.9	0.67	13
Maryland & D.C.****	371	1.8	0.74	32.5	477	3.1	0.95	2
Oklahoma	244	1.2	0.74	32.5	174	1.1	0.53	33
Wisconsin	350	1.7	0.73	34	313	2.0	0.66	15
Iowa	208	1.0	0.72	35	166	1.1	0.58	25.5
Montana	59	0.3	0.71	36	50	0.3	0.61	22
Illinois	810	4.0	0.70	37	690	4.5	0.60	23.5
Wyoming	34	0.2	0.67	38	2	∅	0.04	48
Alaska	34	0.2	0.65	39.5	17	0.1	0.33	45.5
Washington	286	1.4	0.65	39.5	373	2.4	0.85	4
Oregon	168	0.8	0.63	41	209	1.4	0.78	8
Colorado	181	0.9	0.56	42	224	1.5	0.69	11
New Jersey	347	1.7	0.46	43	499	3.3	0.66	15
New York	800	4.0	0.45	44	1,418	9.2	0.80	7
Arizona	140	0.7	0.44	45	241	1.6	0.76	9
Utah	71	0.4	0.43	46	147	1.0	0.89	3
Nevada	38	0.2	0.41	47	78	0.5	0.83	6
California	957	4.8	0.36	48	1,924	12.6	0.73	10
Indiana	119	0.6	0.22	49	353	2.3	0.64	18.5

∅ = less than 0.05 percent.

* Active members in the American Society of Anesthesiology, as of December 31, 1985. These figures will be updated as of December 31, 1986 as soon as the data become available from the ASA.

** Population figures for 1985, from the Bureau of the Census, Boston Regional Office.

*** Active members in the American Association of Nurse Anesthetists as of August 1986.

**** The ASA aggregates membership figures for New Hampshire and Vermont and for Maryland and the District of Columbia. AANA membership figures have also been aggregated for purposes of comparability.

this country are located in nine States (Pennsylvania, Texas, California, Florida, Illinois, Michigan, New York, North Carolina and Ohio). Yet, only four of these nine States (Michigan, North Carolina, Pennsylvania and Ohio) have per capita rates that are at or above the national median of .88 CRNAs per 10,000 population in 1986. The State with the highest per capita rate is South Dakota with 2 CRNAs per 10,000 population, followed by North Dakota (1.88) and Minnesota (1.85).

Table E-2 also shows that three States account for 28 percent of all anesthesiologists in the U.S. (California, New York, and Texas). About 13 percent of all anesthesiologists are located in California alone. While in 17 States there was at least one CRNA per 10,000 population, only one State (Massachusetts) had more than one anesthesiologist per 10,000 population. California ranked tenth on a per capita basis with .73 anesthesiologists per 10,000 population.

This extensive variation in the availability of anesthesia providers across States suggests, first of all, that the use of CRNAs versus anesthesiologists varies widely depending upon relative availabilities. It would also imply that CRNAs are involved in a wide range of simple to complex surgeries in areas where anesthesiologists are scarce.

Organization of Anesthesia Services in Hospitals

Of the 4,192 short-term community hospitals in the U.S., 45 percent utilized both anesthesiologists and CRNAs in the operating room (Table E-3). Another third relied only on CRNAs while 17 percent used anesthesiologists only. The remaining hospitals (4 percent) reportedly used neither anesthesiologists nor CRNAs; rather other physicians (e.g., ophthalmologists, surgeons) or nonphysicians provided anesthesia services.

CRNA-only hospitals accounted for disproportionately few surgical operations because they were much smaller and less surgery-intensive than other hospitals. Of the 15.5 million operations in 1981, only 8 percent were performed in hospitals with CRNAs only. Among all hospitals, anesthesiologists were involved in nine-out-of-ten operations—roughly two-thirds in hospitals using a team of anesthesiologists and CRNAs while one-third were in anesthesiologist-only hospitals. CRNA-only hospitals averaged just 16 surgeries per week compared to at least 100 surgeries in the hospitals with an anesthesiologist (Table E-4).

Hospitals in the West accounted for nearly half of the anesthesiologist arrangements which is not surprising given their abundance in California. CRNA-only hospitals are concentrated in the South and Midwest, possibly because they are smaller or located in more isolated areas and find it more difficult to attract and retain anesthesiologists. The anesthesia care team arrangement was disproportionately represented in the Northeast, perhaps because of the many large academic health centers located in that region.

TABLE E-3

ORGANIZATION OF ANESTHESIA SERVICES IN U.S. HOSPITALS, 1981*

Type of Arrangement	Hospitals		Operations	
	Number	Percent	Number	Percent
Total	4,192	100.0%	15,460,935	100.0%
Anesthesiologist(s) only	727	17.3	3,776,427	24.4
CRNA(s) only	1,428	34.1	1,163,173	7.5
Both anesthesiologist(s) and CRNA(s)	1,881	44.9	10,248,388	66.3
Other provider(s)	156	3.7	272,947	1.8

*Excludes hospitals in the U.S. territories, long-term care hospitals, hospitals with no surgical operations, federal hospitals, and specialty hospitals not meeting HCFA's definition of a community hospital. See text for details.

Sources: 1981 Special Survey of Hospitals, 1982 Annual Survey of Hospitals.

TABLE E-4

ORGANIZATION OF ANESTHESIA SERVICES, BY HOSPITAL LOCATION, 1981

	All Hospitals	MDA Only	CRNA Only	Both MDA and CRNA	Other
Region					
Northeast	15.1%	18.3%	3.6%	23.2%	9.0%
South	31.5	21.1	38.7	29.5	27.6
North Central	35.5	19.1	42.8	36.9	37.8
West	17.9	41.5	14.9	10.4	25.6
Urban/Rural Location					
Urban (SMSA)	52.8%	81.2%	15.3%	72.0%	32.7%
Large SMSA[1]	(49.6)	(65.9)	(25.5)	(46.7)	(39.1)
Small SMSA[1]	(50.4)	(34.1)	(74.5)	(53.3)	(60.9)
Rural (non-SMSA)	47.2	18.8	84.7	28.0	67.3

[1]Large SMSA is greater than 1 million population; small SMSA is less than 1 million population.

Sources: 1981 Special Survey of Hospitals, 1982 Annual Survey of Hospitals.

As might be expected, a strong inverse relationship was found between population size and presence of an anesthesiologist. The vast majority (85 percent) of CRNA-only hospitals were located in rural areas, and even among those in urban areas, three-fourths were in smaller Standard Metropolitan Statistical Areas (SMSAs) (less than 1 million population). This is probably due to the inability of a small hospital to support an anesthesiologist and the undesirability of geographically isolated areas. In contrast, hospitals that relied exclusively on anesthesiologists only were most likely to be located in urban areas (81 percent), predominantly the large SMSAs. The anesthesia care team, utilizing both anesthesiologists and CRNAs, was also found mostly in urban areas. Virtually all hospitals located in large SMSAs had at least one anesthesiologist on their medical staff.

Employment and Payment Arrangements

Based on the 1986 Anesthesia Practice Survey conducted as part of the CHER study, 90 percent of the sampled CRNAs worked in hospital settings with anesthesiologists, while only 10 percent worked in settings with no anesthesiologists. About three out of four anesthesiologists worked in hospitals with CRNAs (with half of these anesthesiologists employing CRNAs) while one-fourth worked alone.

The dominant practice arrangement for anesthesiologists is self-employment in a private practice with payment on a fee-for-service basis. CRNAs are usually employed by a hospital or a physician practice and paid a straight salary or salary plus incentives (e.g., profit sharing, bonus). About 5 percent of all CRNAs (but half of the CRNAs who work alone) are freelance and paid on a fee-for-service basis.

In recent years, the employment patterns of CRNAs have shifted, with an increasing number of CRNAs employed by physicians rather than hospitals.

Usual Activities of CRNAs and Anesthesiologists

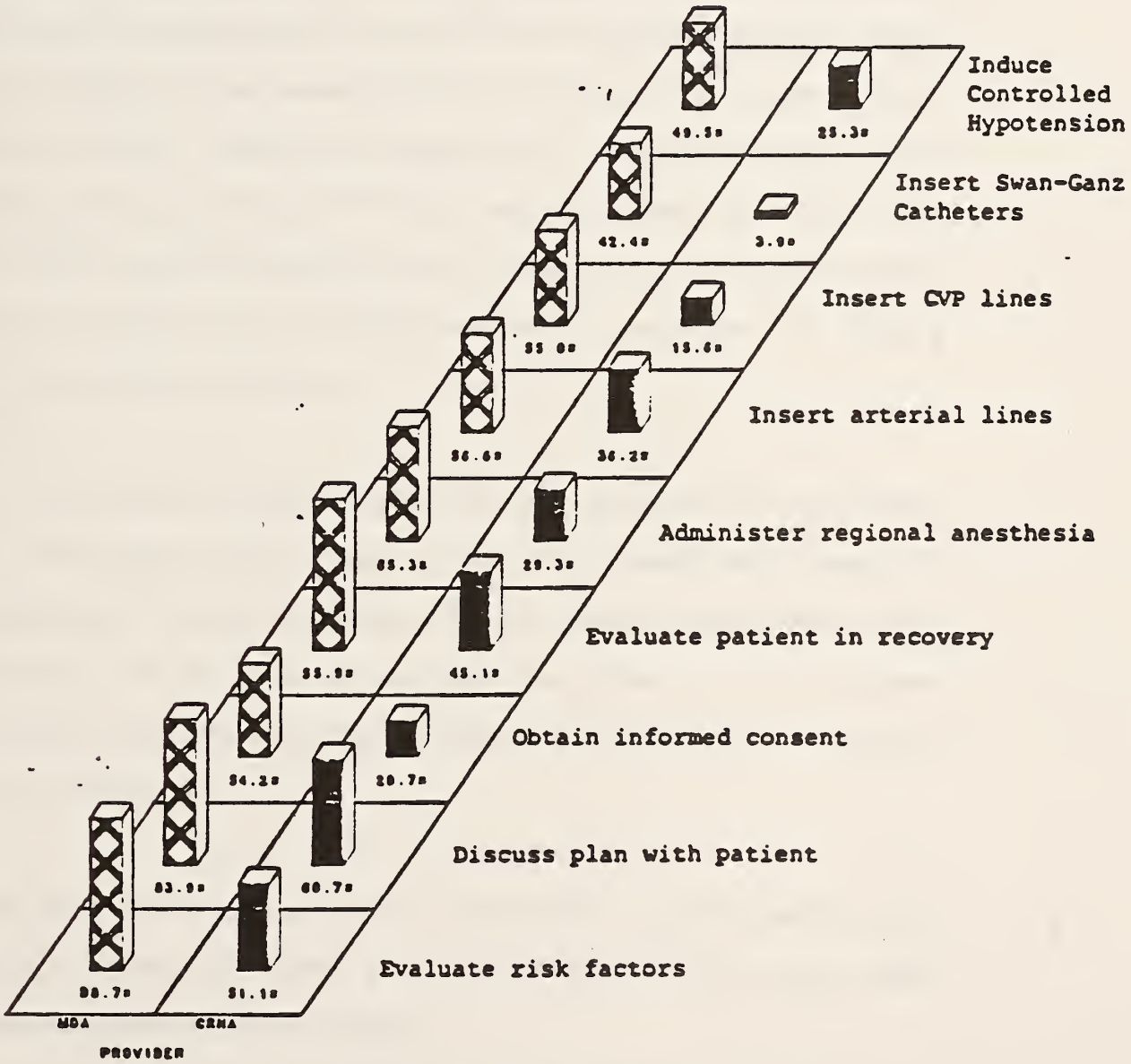
The 1986 Anesthesia Practice Survey also obtained summary information on the frequency with which CRNAs and anesthesiologists perform selected tasks, which could indicate the extent of and limits to the substitutability of CRNAs for anesthesiologists. As can be seen in Figure E-1, anesthesiologists in every case are more likely to regularly perform the nine anesthesiology service tasks defined in the survey.

Both anesthesiologists and CRNAs commonly classify and assign patient risk factors (89 percent of anesthesiologists and 51 percent of CRNAs) or discuss the anesthesia care plan with the patient or family (84 percent vs. 61 percent). On the other hand, anesthesiologists are twice as likely as CRNAs to evaluate the patient in recovery (86 percent vs. 45 percent), probably because many hospitals require an anesthesiologist to discharge the patient from postoperative care. Some hospitals, however, do allow CRNAs to discharge patients with no complications, based on a postoperative scoring system. Of the four nonoperating room tasks identified in Figure E-1, both groups are least likely to obtain informed consent on a regular basis (54 percent vs. 21 percent).

About two-thirds of anesthesiologists but less than one-third of CRNAs regularly administer regional blocks. The delegation of regional anesthesia to CRNAs is a

FIGURE E-1

PERCENT OF CRNAS AND MDAS USUALLY OR ALWAYS PERFORMING SELCTED TASKS



SOURCE: 1986 ANESTHESIA PRACTICE SURVEY

controversial issue for both professional associations, based on quality, economic, and philosophical considerations. Nearly two-thirds of the CRNAs rarely or never perform regional anesthesia, but how many are arbitrarily restricted from doing so by supervising anesthesiologists is unknown.

Another controversial area is the placement of invasive monitoring devices by CRNAs. If CRNAs have any role in this area it is in the insertion of arterial lines: 36 percent say they regularly insert arterial lines when they are required. Only 6 percent insert central venous pressure (CVP) lines, and fewer still (4 percent) insert Swan-Ganz catheters. Among anesthesiologists, 57 percent regularly insert arterial lines, 55 percent insert CVP lines, and 44 percent insert Swan-Ganz catheters. While invasive monitoring is not a frequent activity for either group, clearly anesthesiologists assume the major responsibility, particularly for inserting CVP lines and Swan-Ganz catheters.

The final task, inducing controlled hypotension, is a relatively rare and delicate procedure. Essentially, drugs are used to lower the patient's blood pressure in order to reduce blood flow to the surgical site. This technique may be used in total hip replacement, for example, to decrease blood flow to the hip area. Anesthesiologists were twice as likely as CRNAs to perform this procedure (50 percent vs. 25 percent).

In summary, while CRNAs appear to have a major role in pre and postoperative tasks, they are less likely to perform certain technical aspects of a case, notably regional anesthesia and invasive monitoring.

Surgical and Patient Case Mix

According to the results of the 1986 Anesthesia Practice Survey, CRNAs working alone, on average, performed less complex procedures, with an average complexity of 5.18 base units versus 5.84 and 5.86, for the joint anesthesiologist/CRNA and anesthesiologist-only cases, respectively. These case mix differences were found across both obstetric and nonobstetric cases. Less complex procedures (six or fewer units) accounted for 83 percent of CRNA-only cases versus 76 percent of the cases in the other two groups. At the other extreme CRNAs working alone had noticeably few complex procedures with only 1 percent having more than ten units. In contrast, 6 percent of cases involving an anesthesiologist (either alone or with a CRNA) involved ten or more anesthesia units. Furthermore, the CRNA-only range ended at 16 base units, while the anesthesiologists/CRNA and anesthesiologist-only range extended into the low 20's. It is also worth noting that the anesthesiologist/CRNA and anesthesiologist-only groups have almost identical case mix distributions throughout the range, indicating that CRNAs were indeed involved in the full range of procedures when collaborating with an anesthesiologist.

Quality of Care Provided by CRNAs and Anesthesiologists

CHER conducted a review of the literature and the examined liability issues in anesthesia to address the question of whether the quality of anesthesia care varies by the type of anesthesia provider.

In their literature review, they reviewed three studies that explicitly examined anesthesia outcomes by provider type. None detected significant differences in anesthesia outcomes among CRNAs versus anesthesiologists.

These three studies, taken together, do not appear to provide significant information on the extent to which CRNAs and anesthesiologists might provide care of differing quality. First there is concern over the generalizability of the findings. Also, differences in the designation of the type of anesthesia provider may lead to measurement error and limit the comparability of findings across the studies. A further limitation concerns the subjectivity of the measurement of the outcomes itself. Finally, the studies fail to adequately adjust for systematic differences in pre-operative health status.

Institutional mechanisms that promote the quality of anesthesia care provided by both CRNAs and anesthesiologists may also assure similar outcomes regardless of who the primary provider is. Extensive licensure and certification requirements for providers assure high qualifications of both anesthetists. The Joint Commision on Accreditation of Hospitals (JCAH) sets standards for hospital-based anesthesia services, imposing requirements for quality assurance activities as well as supervision of CRNAs. Consistent with the JCAH standards, the American Society of Anesthesiologists (ASA), American Association of Nurse Anesthetists (AANA), and many State licensure laws require or recommend that facilities develop written guidelines delineating the scope of a nurse anesthetist's practice and the nature of supervision. Quality assurance activities are varied, but usually focus on reducing the incidence of anesthesia complications through careful data collection and

analysis. Another important institutional mechanism relates to the triaging of patients according to an anesthetist's competence. This could be accomplished overtly through clinical privileges or more subtly through scheduling and assignment of cases. Triaging could occur by type of case (e.g., cardiac), by type of anesthetic technique (e.g., regional), or by complexity of invasive monitoring required (e.g., Swan-Ganz catheterization), among other criteria.

In a separate analysis, CHER investigated the potential for using malpractice claims, settlements, and insurance premiums as indicators of quality of care differences between nurse anesthetists and anesthesiologists. They found that because of the "deep pocket" phenomenon (under the doctrine of vicarious liability the plaintiff is likely to seek compensation from the party with the largest insurance coverage, and this is often the employer or physician supervisor rather than the CRNA), it is difficult, from a research perspective, to link liability decisions to quality of care. Surcharges on malpractice insurance premiums have been imposed by some carriers on surgeons who employ CRNAs, but this, again, is probably due to the nature of vicarious liability and does not necessarily reflect an increased likelihood of a mishap. In addition, there is a noticeable absence of surcharges for simply working with (as opposed to actually employing) nurse anesthetists.

CRNA Payment Options

Medicare payment options for CRNA services entail major implications not only for the use of CRNAs but also for the total amount of Medicare anesthesia expenditures. In describing the payment options for CRNA services, it

is necessary to also consider anesthesiologist reimbursement. This is because the two anesthetists can be substitutes for each other across a wide range of surgeries.

It is also necessary to consider current manpower trends in the absence of any policy change. Because the supply of anesthesiologists has been growing more rapidly than the supply of CRNAs, a reimbursement policy providing no incentives or disincentives to use CRNAs versus anesthesiologists will not assure a status quo mix of providers in the future.

The generic payment options under discussion include:

(1) Extending the current CRNA Part A pass-through indefinitely;
(2) Including CRNA services in the Part A hospital DRG payment;
(3) Establishing a DRG payment for all anesthesia services;
(4) Permitting direct Part B billing for CRNA services.

CRNA Part A Pass-Through

Option 1 would continue the CRNA Part A pass-through. As such it is the status quo and any hypothesized trends reflect only the underlying trends in the relative demand and supply of the two providers. Given that the pass-through itself does not discourage or encourage CRNA hospital employment, the growth in the supply of anesthesiologists suggests the slow replacement (or supervision) of CRNAs by anesthesiologists.

CRNA Services in Part A Hospital DRG Payment

Option 2 which once again would include hospital-employed CRNA services under Part A would greatly accelerate the substitution of anesthesiologists for CRNAs. Hospital administrators would not want to be responsible for CRNA wages when they could recruit an anesthesiologist at essentially no cost to the hospital (since physicians bill Medicare and other third parties directly). Anesthesiologists would not be expected to rehire all the laid off CRNAs, reducing the CRNAs net involvement in anesthesia. This would add to the underlying increase in anesthesia costs per operation and be translated into greater Medicare outlays.

Anesthesia DRG

A complete anesthesia DRG would bundle the services of CRNAs and anesthesiologists into a single rate or a rate to be included in a radiology, anesthesia, and pathology (RAP) DRG. If anesthesia was then defined as a hospital inpatient service, payment would be folded into the existing DRG-specific hospital rate and the hospital administration would be responsible for paying both providers. Paying the anesthesia or RAP DRG to a physician group such as a RAP organization in the institution would make it a Part B service. It is also possible to pay the single anesthesia payment specifically to an anesthesiologist rather than a physician group. Finally, it would be administratively possible to even pay the global anesthesia payment to the CRNA under Part B.

An anesthesia DRG paid to the hospital would put the hospital at financial risk for all anesthesia care, encouraging it to choose the mix of CRNAs and anesthesiologists that minimized costs per operation. While this approach probably would enhance the competitive position of CRNAs, it would raise the issue of whether mandatory assignment for anesthesia services would be required as it is for other hospital services.

An anesthesia DRG rate paid to a group of physicians such as the hospitals' anesthesia staff or a consortium of RAPs could have the same general effect on provider mix and Medicare payments as paying the hospital, but the outcome is far less certain. While the physician group would appear to have an obvious interest in minimizing costs by achieving the most economical mix of anesthesia inputs, the physicians themselves, as opposed to hospital administrators, would be making the cost allocations. Payment directed to a physician group would probably not stimulate as much use of CRNAs as would payment to a hospital, for both financial and philosophical considerations.

If Medicare paid the anesthesia DRG rate to the anesthesiologist, CRNA use would probably continue to decline slightly each year—at least relative to anesthesiologists. Although an average rate for all mixes of anesthesiologists and CRNAs could be somewhat less than what anesthesiologists were used to receiving from Medicare, it seems unlikely that anesthesiologists would be discouraged from treating Medicare patients given increased competition and their lack of an independent practice. The extent to which anesthesiologists would choose to hire

more CRNAs to increase their productivity may depend upon the abundance of anesthesiologists in a given area.

DIRECT CRNA BILLING

Effective January 1, 1989, OBRA of 1986 extends direct Part B billing to CRNAs, eliminating the CRNA Part A pass-through. While direct CRNA billing gives CRNAs the option of being financially independent of both hospitals and physicians, it would do little to improve their competitive position relative to anesthesiologists. Anesthesia costs would continue to be irrelevant to both hospitals and surgeons who would thus be inclined to prefer the services of anesthesiologists over CRNAs. Although CRNA payments are intended to be budget neutral, Medicare will be required to establish and administer another fee schedule coupled with an increase in claims, thereby, increasing program costs. These increased programs costs may be offset by the fact that beneficiaries will be liable for the 20 percent Part B coinsurance requirement for all CRNA services, including those previously covered under Part A.

CONCLUSION

Of the four generic payment options, inclusion of CRNA costs in hospital DRG rates while permitting anesthesiologists to continue billing Medicare directly has already been shown to discourage the use of CRNAs during the first year of Medicare's PPS. While some anesthesiologists would hire CRNAs, the overall effect would be a net increase in Medicare's payments for anesthesia services.

Continuation of the Part A CRNA pass-through to hospitals or the planned extension of direct billing privileges to CRNAs would have little impact upon current trends in the delivery of anesthesia services. While these payment options would not discourage the use of CRNAs, neither would their use be encouraged. While the direct billing provision will provide CRNAs with the satisfaction of being financially independent, neither the pass-through nor the direct billing option will encourage better productivity or efficiency in hospitals. Given the relative increase in the supply of anesthesiologists combined with the competitive pressures on hospitals to enhance services, anesthesiologists, over time, would assume a relatively greater role in the delivery of anesthesia services with the resultant increase in costs to the Medicare program. However, as previously noted, the CRNA direct billing provision would increase both Medicare's program administration costs and the amount of beneficiary cost sharing.

An anesthesia DRG rate would have the potential for curtailing the rise in Medicare costs by controlling the rates paid for anesthesia services, but the impact upon the competitive position of CRNAs would depend upon the person or organization to whom such payments were made.

As the Kaiser case study has shown, many hospitals will continue to recruit anesthesiologists over CRNAs regardless of cost. In addition, with the increasing supply of anesthesiologists in the U.S. relative to the supply of CRNAs, the trend of greater roles for anesthesiologists in the delivery of anesthesia services would appear to continue. The current Part A CRNA pass-through and the subsequent

CRNA direct billing provision will not discourage the use of CRNAs by hospitals. However, an anesthesia DRG payment system may be a feasible means of curtailing the rate of increase in Medicare's payments for anesthesia services and possibly strengthening the CRNAs' competitive position.

CHAPTER I

INTRODUCTION

This report has been prepared in accordance with Section 2312(d) of the Deficit Reduction Act of 1984, Public Law 98-369, which mandated a "study of possible methods of reimbursement under Title XVIII of the Social Security Act which would not discourage the use of Certified Registered Nurse Anesthetists (CRNAs) by hospitals." The purpose of this report is to delineate alternative Medicare payment options for CRNAs, describe anesthesia practice patterns in the U.S., and discuss the current role and status of CRNAs in the delivery of anesthesia services. Discussions within this report are limited, for the most part, to inpatient hospital services.

In order to obtain background information for the report, HCFA awarded, on September 30, 1985, a cooperative agreement to CHER Needham, Massachusetts, to collect and analyze data on the activities and employment settings of CRNAs. The full presentation of its findings is contained in its report, "Payment Options for Nonphysician Anesthetists Under Medicare's Prospective Payment System."

CHER conducted the study using two basic approaches. In order to gather information on the range of CRNA activities and the types of cases in which CRNAs are involved, CHER's contractor, American Institutes for Research (AIR), conducted a telephone survey in the fall of 1986 of CRNAs and anesthesiologists across the country. The resulting data, over 500 responses from each of the two

NOTE: On tables and exhibits in this report, MDA refers to Medical Doctor of Anesthesiology.

professions, were then analyzed by CHER. At the same time, CHER reviewed secondary data from several sources, including the American Hospital Association (AHA), the HCFA-National Opinion Research Center (NORC) survey, and the AANA, to assess quality issues and practice patterns.

In addition, CHER has conducted a case study on the delivery of anesthesia services in the Kaiser System (Southern California) to ascertain how a capitated health care delivery system chooses to utilize CRNAs and anesthesiologists. That case study has been included as an appendix to this report.

Background

The Medicare PPS dramatically altered the method of paying for anesthesia services performed by CRNAs. Beginning October 1, 1983, the services of CRNAs who were employed by or under contract to a hospital were included in the Medicare Part A DRG payment, while the services of CRNAs employed by physicians continued to be billed under Part B on a reasonable charge basis. Under this arrangement, hospitals faced a strong financial incentive to discontinue employing (or contracting with) CRNAs and to shift the cost of anesthesia services to Part B.

Recognizing the incentives that hospitals faced under these provisions, Congress included in the Deficit Reduction Act of 1984 a modification of the mechanism for reimbursing services furnished by CRNAs employed by hospitals. As of October 1, 1984, the cost of CRNA services was removed from the DRG payment and hospitals began to "pass-through" the reasonable cost of CRNA services under Part

A, thereby removing the incentive to replace CRNAs with physicians who were allowed to bill under Part B.

The pass-through provision was intended as a temporary measure scheduled to expire on October 1, 1987. However, Section 9320 of (OBRA) of 1986 extended the hospital CRNA pass-through provision to January 1, 1989, and allowed for direct fee-for-service billing for CRNA services by CRNAs or their employers thereafter. Under the CRNA direct billing provision, Medicare payments are not to exceed what would have been paid without the direct billing provision, CRNAs must accept assignment, CRNA billings are to be paid from the Part B trust fund and are subject to the 20 percent coinsurance provision, and, if necessary, rates paid to anesthesiologists for medical supervision will be reduced to ensure the direct billing provision is budget neutral. Although CRNAs may assign their billing rights to a hospital or physician by whom they are employed or have a contractual agreement, billings for CRNA services are subject to the same restrictions. The Secretary of the Department of Health and Human Services has been charged with the responsibility of developing a fee schedule for payment of CRNA services, initially to be based on audited data from cost reporting periods ending in fiscal year 1985.

Current Medicare Reimbursement Practice

Under current law, anesthesia services are paid under both Part A and Part B of the Medicare program. Part A covers services furnished by nonphysician anesthetists, including CRNAs, who are employed by or independently contracting with a hospital. Payments are made on the basis of reasonable cost principles and

are treated as a "pass-through." In other words, payments are separate from the Part A DRG payment under PPS. For calendar year 1986, these pass-through Medicare pass-through payments for CRNA services amounted to $69,000,000.

The pass-through provision went into effect in October 1984 in response to concerns that Medicare's PPS provided a disincentive to using CRNAs. When the cost of CRNA services incurred by hospitals was initially included in the Part A DRG payment, hospitals relying strictly upon anesthesiologists and the CRNAs they employed were at a decided financial advantage, and hospitals began dismissing their CRNA employees. (An unknown number of CRNAs were hired directly by anesthesiologists.) The pass-through provision provides a temporary shelter for nonphysicians anesthetists from the incentives inherent in the Part A/Part B split in anesthesia services.

Part B reimburses anesthesiologists on a reasonable charge basis for services they furnish. The payment amount depends on whether the anesthesiologist is performing anesthesia alone, supervising a CRNA employed by the anesthesiologist's practice, or supervising a CRNA employed by the hospital. A relative value unit method is used to determine the payment, including base value units corresponding to the complexity of the procedure; time units reflecting the length of the procedure (beginning when the anesthesiologist prepares the patient for induction through the point when the anesthesiologist is no longer personally attending the patient); and modifier units, used at the Medicare carrier's option, to account for special circumstances such as the patient's age or physical status. The number of units in each category is summed and then multiplied by a conversion factor to determine the reasonable charge. For calendar year 1986, Medicare payments to anesthesiologists for inpatient services were estimated to have been about $750,000,000.

When an anesthesiologist performs the anesthesia alone, time units are calculated on the basis of 15 minute time intervals (e.g., 1 hour = 4 units). Similarly, when an anesthesiologist supervises a CRNA under his/her employ, 15 minute intervals are used, covering the CRNA's wage and paying for the anesthesiologist's medical direction. When an anesthesiologist supervises a CRNA employed by a hospital, time units are based on 30 minute intervals (e.g., 1 hour = 2 units). The time units are diminished because the anesthesiologist does not pay the CRNA's salary. However, the base units and modifier units are not reduced. Anesthesiologists may supervise up to four concurrent procedures under present regulations and still receive Part B payment. If more than four concurrent procedures are supervised, it is considered supervision, a service to the hospital rather than an individual patient, and the anesthesiologist's services are covered under Part A.

A few examples show how the reasonable charge is derived under differing scenarios. For illustrative purposes, the surgical procedures are each 60 minutes in duration, and each case is valued at 5 base units and 3 modifier units with a conversion factor of $20.

Example 1: anesthesiologist works alone

Base units =	5
Time (60/15 minutes) units =	4
Modifier units =	3
Total units	12
Conversion factor	x $ 20
Reasonable charge	$240

Example 2: anesthesiologist supervises CRNA who is his/her employee

Base units =	5
Time (60/15 minutes) units =	4
Modifier units =	3
Total units	12
Conversion factor	x $ 20
Reasonable charge	$240

Example 3: anesthesiologist supervises 2 of his/her CRNA employees concurrently for the same or equivalent procedure

Base units =		5	
Time (60/15 minutes) units =		4	
Modifier units =		3	
Total units		12	
Conversion factor	x	$ 20	
		$240	
Concurrent operations	x	2	
Reasonable charge		$480	(Two operations @ $240 each)

Example 4: anesthesiologist supervises CRNA employed by hospital

Base units =		5	
Time (60/30 minutes) units =		2	
Modifier units =		3	
Total units		10	
Conversion factor	x	$ 20	
Reasonable charge		$200	

Example 5: anesthesiologist concurrently supervises 2 CRNAs employed hospital for the same or equivalent procedure

Base units =		5	
Time (60/30 minutes) units =		2	
Modifier units =		3	
Total units		10	
Conversion factor	x	$ 20	
		$200	
Concurrent operations	x	2	
Reasonable charge		$400	(Two operations @ $200 each)

As illustrated in the above examples of identical surgical procedures, the reasonable charge per case for an anesthesiologist working alone or for an anesthesiologist supervising a CRNA in his/her employ would be $240 while the anesthesiologist supervising a hospital-employed CRNA would receive $200. However, if the anesthesiologist supervises two or more cases concurrently, the anesthesiologist reasonable charge per case remains unchanged. In examples 3 and 5 with two concurrent procedures, the reasonable charge for the employer

anesthesiologist would be a total of $480 while the reasonable charge for the anesthesiologist supervising hospital employees would be $400.

Manpower Trends

Currently, two separate, but related, trends in the supply of anesthesia providers can be documented: a steady increase in the availability of physicians specially trained in anesthesiology and a leveling off in the number of CRNAs. While in 1967 there were 813,400 CRNAs in the U.S. and 7,864 anesthesiologists; in 1986 there were 22,529 CRNAs and 18,956 anesthesiologists (Table 1-1). Thus, over this 20 year period, the number of CRNAs has increased by 68 percent versus a 116 percent increase for anesthesiologists. However, the number of CRNAs has remained relatively constant since 1984, fluctuating between 22,312 and 22,719.

Additional evidence on the number of new entrants and attrition from retirement seems to suggest that the number of CRNAs will remain constant or even gradually decline, while the number of anesthesiologists will continue to grow. Table 1-2 shows the number of accredited nurse anesthesia programs in the U.S. and the number of graduates. The number of programs has dropped by one-third from 1981-1987 with a comparable reduction in the number of graduates from 1983-1987.

The opposite trend is found in the number of anesthesiology residents in the U.S. As the number of U.S. medical school graduates has increased over the last two decades, the number of anesthesiology residents has more than tripled since 1967 and has increased by 50 percent since 1980 (See Table 1-3). Along with the

TABLE 1-1

NUMBER OF CRNAs AND ANESTHESIOLOGISTS, U.S., 1967-1986

Year	Number of CRNAs*	Number of Anesthesiologists**
1967	13,408	7,864
1968	13,665	8,094
1969	14,053	8,261
1970	14,532	8,668
1971	14,970	9,044
1972	15,525	9,415
1973	15,952	10,022
1974	16,832	10,657
1975	17,167	11,243
1976	17,239	11,871
1977	17,965	12,525
1978	18,856	13,235
1979	19,443	13,894
1980	19,975	14,559
1981	20,377	15,193
1982	21,079	15,936
1983	21,622	16,598
1984	22,312	17,263
1985	22,719	18,067
1986	22,529	18,956

*These figures represent the number of members in the American Association of Nurse Anesthetists, excluding nurse anesthesia students.

**These figures represent the number of members in the American Society of Anesthesiologists, excluding anesthesiology residents.

Sources: Josephine Heimler, Membership Director, American Association of Nurse Anesthetists, Personal Communication, December 1986.

Committee on Manpower, American Society of Anesthesiologists, Annual Report, September 1986.

TABLE 1-2

NUMBER OF NURSE ANESTHESIA PROGRAMS AND GRADUATES, 1981-1987

Year	Number of Accredited Programs	Number of Graduates
1981	148	NA
1982	142	NA
1983	137	981
1984	127	930
1985	112	892
1986	104	671
1987	99	636*

NA = Not Available.

*Projected.

Source: Council on Certification and Recertification, American Association of Nurse Anesthetists, Unpublished data.

TABLE 1-3

NUMBER OF ANESTHESIOLOGY RESIDENTS AND PERCENT FOREIGN TRAINED, 1967-1986

Year	Number of Residents	Percent Foreign Trained
1967	1,320	50.0
1968	1,493	50.0
1969	1,651	51.0
1970	1,740	51.8
1971	1,911	54.6
1972	2,044	57.9
1973	2,217	56.3
1974	2,234	53.6
1975	2,307	50.8
1976	2,374	47.9
1977	2,450	46.4
1978	2,421	43.5
1979	2,403	38.2
1980	2,522	34.7
1981	2,996	29.6
1982	3,289	26.5
1983	3,627	19.4
1984	3,834	16.6
1985	3,931	13.5
1986	3,998	10.7

Source: Committee on Manpower, American Society of Anesthesiologists, Annual Report, September 1986.

expansion of anesthesia residency programs, there has been a concommitant reduction in the percent of residents receiving their undergraduate medical education on foreign countries. The rate of foreign medical graduates in anesthesia residencies reached a high of 58 percent in 1973, but has declined to 11 percent in 1986.

Organization of Report

This report describes the current practice patterns and activities of CRNAs and anesthesiologists in the U.S., presents available information on quality of care issues, and discusses generic payment options for CRNAs.

Chapter 2 presents a synthesis of national data on anesthesia practice patterns, based on three existing data sources: the 1985 AANA Membership Survey, the 1983 AHA Special Survey of Hospitals' Organization of Anesthesia Services, and the 1984-85 HCFA-NORC Survey of Physicians.

Chapters 3 and 4 are based upon the findings of CHER's Provider Practice Survey. Chapter 3 presents data on CRNAs' and anesthesiologists' hospital affiliations, employment and payment arrangements, work effort, and usual activities, while Chapter 4 compares the patient characteristics, diagnostic case mix, and surgical procedures for each of the two anesthesia providers.

Chapter 5 summarizes available literature relating to quality of care of the two providers. Chapter 6 discusses the issue of malpractice claims and insurance premiums for physicians employing or supervisoring CRNAs. Chapter 7 presents

possible CRNA payment options and their implications for both CRNA employment opportunities and Medicare anesthesia costs.

CHAPTER 2

ANESTHESIA PRACTICE PATTERNS IN THE UNITED STATES

In the United States, anesthesia services are provided by anesthesiologists, anesthesia residents, anesthesiologist assistants (AA)*, and CRNAs. A 1981 survey of hospitals, conducted by the AHA with support from the ASA found that CRNAs were present in about four-fifths of all hospitals. This chapter draws on existing secondary data sources to develop a profile of practice patterns of anesthesiologists and CRNAs in the U.S.

Geographic Distribution of Anesthesia Providers in the U.S.

This section describes the geographic location of CRNAs and anesthesiologists. Data were obtained from the AANA and the ASA on the number of active members in each organization. Data for the CRNAs are as of August 1986 and for anesthesiologists as of December 31, 1985. Both professional societies are considered to be very representative and inclusive of their respective constituencies.

*AAs are trained at Emory University in a 6 year program leading to a Master of Medical Science in anesthesiology/patient monitoring systems.

Table 2-1 displays the number of CRNAs and anesthesiologists in each State, the percent of total providers in that State, the rate per 10,000 population, and the rank across States. Two States each have more than 1,000 CRNAs, Pennsylvania (1,800) and Texas (1,400), accounting for 16 percent of all CRNAs. On a per capita basis South Dakota ranks first with two CRNAs per 10,000 population, followed by North Dakota (1.88) and Minnesota (1.85).

Three States account for 28 percent of the anesthesiologists in the U.S.: California (1,900), New York (1,400), and Texas (1,000). About 13 percent of all anesthesiologists are located in California alone. The per capita rate for anesthesiologists is, in all States, less than 1 per 10,000 population. Massachusetts has the highest rate (0.97 per 10,000 population), followed by Maryland/D.C. (0.95), and Utah (.89).

In Table 2-2, the States are arranged according to the rate of CRNAs and anesthesiologists per population, relative to the national medians. Six States are above the national median rates for both CRNAs and anesthesiologists (category I). These States tend to have urban areas that may employ the anesthesia care team concept, as well as rural areas that may rely to a larger extent on CRNAs. In addition, most of these States have large university or hospital-based training programs in nurse anesthesia as well as anesthesiology residency programs.

At the other extreme, eight States are below the median rates for both CRNAs and anesthesiologists (category IV). All of these States have large rural areas and tend to have a below average rate of hospital beds per capita. Thus, it should not be

TABLE 2-1

GEOGRAPHIC DISTRIBUTION OF ANESTHESIA PROVIDERS IN THE U.S., 1986

	CRNAs				Anesthesiologists			
	Number[&&&]	Percent of Total	Per 10,000 Population[&&]	Rank	Number[&]	Percent of Total	Per 10,000 Population[&&]	Rank
South Dakota	141	0.7	1.99	1				
North Dakota	129	0.6	1.88	2	31	0.2	0.45[&&&&]	39.5
Minnesota	774	3.9	1.85	3	272	1.8	0.65[&&&&]	17
Louisiana	723	3.6	1.61	4	201	1.3	0.45[&&&&]	39.5
Pennsylvania	1,772	8.8	1.49	5	788	5.1	0.66	15
West Virginia	279	1.4	1.44	6	93	0.6	0.48	37.5
Alabama	562	2.8	1.40	7	170	1.1	0.42	42
North Carolina	863	4.3	1.38	8	273	1.8	0.44	41
Kansas	326	1.6	1.33	9	121	0.8	0.49	36
Tennessee	625	3.1	1.31	10	298	1.9	0.63	20
Delaware	78	0.4	1.25	11	36	0.2	0.58	25.5
Missouri	611	3.0	1.21	12	269	1.8	0.53	33
Nebraska	193	1.0	1.20	13	77	0.5	0.48	37.5
Michigan	992	4.9	1.09	14	486	3.2	0.53	33
Maine	125	0.6	1.07	15	65	0.4	0.56	29
Arkansas	243	1.2	1.03	16	79	0.5	0.34	44
Mississippi	263	1.3	1.01	17	86	0.6	0.33	45.5
Hawaii	104	0.5	0.99	19	67	0.4	0.64	18.5
Idaho	99	0.5	0.99	19	32	0.2	0.32	47
South Carolina	333	1.7	0.99	19	131	0.9	0.39	43
Virginia	525	2.6	0.92	21	306	2.0	0.54	30.5
Georgia	546	2.7	0.91	22	342	2.2	0.57	27.5
Connecticut	287	1.4	0.90	23	267	1.7	0.84	5
Ohio	946	4.7	0.88	24	729	4.8	0.68	12

[&] Active members in the American Society of Anesthesiology, as of December 31, 1985. These figures will be updated as of December 31, 1986 as soon as the data become available from the ASA.

[&&] Population figures for 1985, from the Bureau of the Census, Boston Regional Office.

[&&&] Active members in the American Association of Nurse Anesthetists as of August 1986.

[&&&&] Anesthesiologists in South Dakota are included with the figures for North Dakota or Minnesota. When the revised figures become available from the ASA for December 31, 1986, the members in South Dakota will be

TABLE 2-1(continued)

GEOGRAPHIC DISTRIBUTION OF ANESTHESIOLOGY PROVIDERS IN THE U.S.

	CRNAs				Anesthesiologists			
Totals	Number***	Percent of Total	Per 10,000 Population**	Rank	Number*	Percent of Total	Per 10,000 Population**	Rank
Rhode Island	81	0.4	0.84	25.5	58	0.4	0.60	23.5
Texas	1,382	6.9	0.84	25.5	1,011	6.6	0.62	21
New Hampshire and Vermont	125	0.6	1.20	27	77	0.5	0.50	35
New Mexico	117	0.6	0.81	28.5	82	0.5	0.57	27.5
Kentucky	301	1.5	0.81	28.5	201	1.3	0.54	30.5
Massachusetts	456	2.3	0.78	30	565	3.7	0.97	1
Florida	860	4.3	0.76	31	758	4.9	0.67	13
Maryland & D.C.****	371	1.8	0.74	32.5	477	3.1	0.95	2
Oklahoma	244	1.2	0.74	32.5	174	1.1	0.53	33
Wisconsin	350	1.7	0.73	34	313	2.0	0.66	15
Iowa	208	1.0	0.72	35	166	1.1	0.58	25.5
Montana	59	0.3	0.71	36	50	0.3	0.61	22
Illinois	810	4.0	0.70	37	690	4.5	0.60	23.5
Wyoming	34	0.2	0.67	38	2	∅	0.04	48
Alaska	34	0.2	0.65	39.5	17	0.1	0.33	45.5
Washington	286	1.4	0.65	39.5	373	2.4	0.85	4
Oregon	168	0.8	0.63	41	209	1.4	0.78	8
Colorado	181	0.9	0.56	42	224	1.5	0.69	11
New Jersey	347	1.7	0.46	43	499	3.3	0.66	15
New York	800	4.0	0.45	44	1,418	9.2	0.80	7
Arizona	140	0.7	0.44	45	241	1.6	0.76	9
Utah	71	0.4	0.43	46	147	1.0	0.89	3
Nevada	38	0.2	0.41	47	78	0.5	0.83	6
California	957	4.8	0.36	48	1,924	12.6	0.73	10
Indiana	119	0.6	0.22	49	353	2.3	0.64	18.5

∅ = less than 0.05 percent.

* Active members in the American Society of Anesthesiology, as of December 31, 1985. These figures will be updated as of December 31, 1986 as soon as the data become available from the ASA.

** Population figures for 1985, from the Bureau of the Census, Boston Regional Office.

*** Active members in the American Association of Nurse Anesthetists as of August 1986.

**** The ASA aggregates membership figures for New Hampshire and Vermont and for Maryland and the District of Columbia. AANA membership figures have also been aggregated for purposes of comparability.

TABLE 2- 2

DISTRIBUTION OF ANESTHESIOLOGISTS AND CRNAs PER 10,000 POPULATION BY STATE

Anesthesiologists Per 10,000 Population	CRNAs Per 10,000 Population: At or Above the Median*	CRNAs Per 10,000 Population: Below the Median
At or Above the Median	Connecticut Hawaii Minnesota Ohio Pennsylvania Tennessee **I**	Arizona California Colorado Florida Illinois Indiana Maryland and D.C. Massachusetts Montana Nevada New Jersey New York Oregon Rhode Island Texas Utah Washington Wisconsin **II**
Below the Median	Alabama Arkansas Delaware Georgia Idaho Kansas Louisiana Maine Michigan Mississippi Missouri Nebraska North Carolina North Dakota South Carolina Virginia West Virginia **III**	Alaska Iowa Kentucky New Hampshire and Vermont New Mexico Oklahoma Wyoming **IV**

*In addition, South Dakota is above the median for CRNAs (ranked number 1).

Note: Median per capita rate for CRNAs is .88 CRNAs per 10,000 population.
Median per capita rate for MDAs is .58 MDAs per 10,000 population.

Source: 1981 Special Survey of Hospitals, 1982 Annual Survey of Hospitals.

surprising that the rate of anesthetists (CRNAs and anesthesiologists) per capita is also below average.

In 17 States, the availability of CRNAs per capita is above the median but the rate of anesthesiologists per capita is below the median (category III). The majority of these States are in the South or North Central regions where hospitals have historically relied on CRNAs working under a surgeon's supervision in the absence of anesthesiologists.

Finally 19 States have an above average rate of anesthesiologists per capita and below average rate of CRNAs (category II). In many cases these are the same States with high physician-population ratios overall. Nonetheless, in only 12 States (all in this group) is the rate of anesthesiologists per capita higher than that of CRNAs.

Variations in Hospital Organization of Anesthesia Services

Although anesthesia services may be provided in nonhospital settings such as freestanding surgery centers and physicians' and dentists' offices, the vast majority of the nation's anesthesiologists and CRNAs are hospital based. This section presents an overview of the organization of anesthesia services in U.S. hospitals using the 1981 Special Survey of Hospitals conducted by the AHA, with partial support from the ASA. Of the 6,964 active U.S. hospitals, 77.2 percent responded to the survey. Of these 6,221 hospitals (87.3 percent) performing surgery, 4,563 (73.3 percent) provided data on anesthesia care providers (ASA, 1983). Data from the 1982 Annual Survey of Hospitals were merged to the Special Survey. Hospitals

not performing any surgical operations were excluded as were hospitals in the U.S. territories, long-term care hospitals, Federal hospitals, and certain speciality hospitals.

The sample analyzed here contained 4,192 short-term community hospitals, 45 percent of which utilized both anesthesiologists and CRNAs in the operating room (Table 2-3). Another third relied on CRNAs only, while 17 percent used anesthesiologists only. The remaining hospitals (4 percent) reportedly used neither anesthesiologists nor CRNAs. This analysis focuses on the first three hospital types.

Table 2-3 also shows that anesthesiologists were involved in 9-out-of-10 operations--roughly two-thirds of which were in hospitals with both anesthesiologists and CRNAs, while one-fourth were in anesthesiologist only hospitals. The CRNA-only hospitals accounted for disproportionately few surgical operations, were smaller, and were less surgery-intensive than other hospitals.

Hospital Location

Regional patterns in the organization of anesthesia services are presented in Table 2-4. Hospitals in the West accounted for most of the anesthesiologist-only arrangements (42 percent) with a correspondingly low utilization of CRNAs. The CRNA-only hospitals were most heavily concentrated in the South (39 percent) or in the North Central region (43 percent), where hospitals are smaller, on average, or tend to be located in more isolated areas. The anesthesia care team arrangement was disproportionately represented in the Northeast.

TABLE 2-3

ORGANIZATION OF ANESTHESIA SERVICES IN U.S. HOSPITALS, 1981*

Type of Arrangement	Hospitals		Operations	
	Number	Percent	Number	Percent
Total	4,192	100.0%	15,460,935	100.0%
Anesthesiologist(s) only	727	17.3	3,776,427	24.4
CRNA(s) only	1,428	34.1	1,163,173	7.5
Both anesthesiologist(s) and CRNA(s)	1,881	44.9	10,248,388	66.3
Other provider(s)	156	3.7	272,947	1.8

*Excludes hospitals in the U.S. territories, long-term care hospitals, hospitals with no surgical operations, federal hospitals, and specialty hospitals not meeting HCFA's definition of a community hospital. See text for details.

Sources: 1981 Special Survey of Hospitals, 1982 Annual Survey of Hospitals.

TABLE 2-4

ORGANIZATION OF ANESTHESIA SERVICES, BY HOSPITAL LOCATION, 1981

	All Hospitals	MDA Only	CRNA Only	Both MDA and CRNA	Other
Region					
Northeast	15.1%	18.3%	3.6%	23.2%	9.0%
South	31.5	21.1	38.7	29.5	27.6
North Central	35.5	19.1	42.8	36.9	37.8
West	17.9	41.5	14.9	10.4	25.6
Urban/Rural Location					
Urban (SMSA)	52.8%	81.2%	15.3%	72.0%	32.7%
Large SMSA[1]	(49.6)	(65.9)	(25.5)	(46.7)	(39.1)
Small SMSA[1]	(50.4)	(34.1)	(74.5)	(53.3)	(60.9)
Rural (non-SMSA)	47.2	18.8	84.7	28.0	67.3

[1]Large SMSA is greater than 1 million population; small SMSA is less than 1 million population.

Sources: 1981 Special Survey of Hospitals, 1982 Annual Survey of Hospitals.

Table 2-4 also shows that there is an inverse relationship between population size and presence of an anesthesiologist. The vast majority (85 percent) of CRNA-only hospitals are located in rural areas, and even among those in urban areas, three-fourths are in smaller SMSAs (less than 1 million population). In contrast, hospitals that relied on anesthesiologists only were most likely to be located in urban areas (81 percent), predominantly in the large SMSAs. The anesthesiologist/CRNA team was also found mostly in urban areas but was slightly more common in rural areas than the anesthesiologist-only arrangement.

Hospital Characteristics

The organization of anesthesia services also varied across hospital types, according to ownership, bed size, JCAH accreditation status, and medical school affiliation (Table 2-5). The CRNA-only hospitals were far more likely (49 percent) to be operated by public (non-Federal) authorities, than either the anesthesiologist-only (17 percent) or anesthesiologist/CRNA hospitals (20 percent). Both the anesthesiologist-only and anesthesiologist/CRNA hospitals were predominantly private, nonprofit institutions and anesthesiologist-only hospitals were disproportionately more likely to be investor-owned. CRNA-only hospitals were considerably smaller, on average (51 beds), than the anesthesiologist/CRNA hospitals (182 beds) and anesthesiologist-only hospitals (171 beds). Data on JCAH accreditation and medical school affiliation support the notion that CRNA-only hospitals are less likely to be performing complex procedures. First, CRNA-only hospitals were much less likely to be accredited by the JCAH (61 percent vs. 93-94

TABLE 2-5

SELECTED HOSPITAL CHARACTERISTICS, BY ORGANIZATION OF ANESTHESIA SERVICES, 1981

	All Hospitals	MDA Only	CRNA Only	Both MDA and CRNA	Other
Ownership					
Public, nonfederal	29.7	16.8	48.9	19.5	37.2
Private, not for profit	60.0	67.3	43.6	70.5	50.0
Invester-owned	10.3	16.0	7.5	10.0	12.8
Bedsize					
6-49 beds	18.2	6.7	40.2	4.9	30.1
50-199 beds	47.8	43.6	56.9	41.9	54.5
200-399 beds	22.2	30.7	2.2	34.7	15.4
400 or more beds	11.8	19.0	0.7	18.5	0.0
Average number of beds per hospital	131.2	170.6	50.7	182.2	70.2
JCAH Accreditation	80.7	94.0	60.7	92.6	58.3
Medical School Affiliation	6.2	8.1	0.2	10.6	0.0
Selected Services*					
Ambulatory Surgical Service	88.8	96.1	76.3	95.7	83.3
Postoperative recovery room	93.0	98.0	83.4	99.0	81.9
Medical/surgical intensive care	85.3	94.8	68.4	95.1	70.8
Cardiac intensive care	78.4	89.1	61.0	88.2	63.9
Respiratory Therapy	93.3	97.3	86.5	97.5	83.3
Emergency department	95.6	94.7	96.9	95.0	95.8
County per capita income	$10,385	$11,766	$9,095	$10,876	$9,810

*Refers to hospital-based services only.

Sources: 1981 Special Survery of Hospitals, 1982 Annual Survey of Hospitals.

percent), and, virtually no CRNA-only hospitals were affiliated with a medical school compared to 8-11 percent of the hospitals with an anesthesiologist.

In addition, CRNA-only hospitals were less likely to provide certain specialized services such as ambulatory surgery, postoperative recovery room, intensive care, cardiac intensive care, and respiratory therapy than hospitals with an anesthesiologist, either alone or in combination with CRNAs (Table 2-5). By contrast, emergency services were equally available in all three types of hospitals. Regarding the per capita income of the community in which the hospital is located, hospitals with an anesthesiologist appear in the wealthiest areas, while CRNA-only hospitals were located in counties with the lowest average per capita income.

The volume of inpatient services was lower in CRNA-only hospitals (Table 2-6), with the magnitude of volume differences exceeding the bed size differences. In 1981, CRNA-only hospitals averaged 2,245 discharges compared to an average of 9,097 discharges for anesthesiologist-only hospitals and 9,668 discharges for hospitals with both anesthesiologists and CRNAs. Utilization differences between hospitals with and without anesthesiologists are even more apparent when looking at average number of inpatient days; 13,509 for CRNA-only hospitals versus 66,120 for anesthesiologist-only and 72,229 for CRNA/anesthesiologist hospitals. These differences may be due to case mix. Hospitals with anesthesiologists are undoubtedly treating more complicated cases, as reflected in longer average lengths of stay. CRNA-only hospitals had a relatively larger Medicare caseload, a much lower surgical intensity, and relatively less emphasis on outpatient surgery.

TABLE 2-6

VOLUME OF INPATIENT SERVICES, BY ORGANIZATION OF ANESTHESIA SERVICES, 1981

	All Hospitals	MDA Only	CRNA Only	Both MDA and CRNA	Other
Average number of discharge	6,813	9,097	2,245	9,668	3,543
Percent of Medicare discharges	34.1%	33.3%	38.6%	31.0%	36.8%
Average number of discharge days	49,327	66,119	13,813	72,691	23,963
Average length of stay	6.8	7.0	6.0	7.2	6.7
Average Number of Surgeries					
Total	3,688	5,195	815	5,448	1,750
Inpatient	2,928	4,114	674	4,306	1,430
Outpatient	760	1,081	141	1,142	320
(Percent of Total)	(17.7%)	(20.1%)	(14.5%)	(19.0%)	(20.3%)
Average number of surgeries per week	70.9	99.9	15.7	104.8	33.7

Sources: 1981 Special Survey of Hospitals, 1982 Annual Survey of Hospitals.

Employment Arrangements and Income of Anesthesiologists

While the 1981 hospital survey clearly suggests that patterns of anesthesia care delivery vary by geographic location, hospital size, and other hospital characteristics, the hospital-level data are silent on the characteristics of providers within each of these organizational settings. With recent data from a HCFA-funded survey of a nationally representative sample of physicians (including anesthesiologists), however, a comparison of the characteristics of anesthesiologists according to their level of involvement with CRNAs as well as their hospital financial arrangements, work effort, and net income was possible.

The primary data source for this analysis was the 1984-85 Physician Practice Costs and Income Survey (PPCIS) conducted by NORC for HCFA.* The PPCIS is a nationally representative sample of 4,729 physicians. The overall participation rate was 68 percent. The data findings presented in this section are weighted to provide national estimates. The 328 physicians who self-reported their primary specialty as anesthesiology, then represent approximately 11,419 anesthesiologists nationwide. When adjustments are made for differences in sample scope, the weighted estimate from the PPCIS is comparable to estimates from the American Medical Association (AMA) which reports there are 18,253 physicians whose primary specialty is anesthesiology (AMA, 1985). All anesthesiologists were administered a detailed self-reported questionnaire on work effort, practice costs, size and type of practice, physician income and fees.

Fully 72 percent of all anesthesiologists are self-employed; another 21 percent are employed by a clinic, health maintenance organization other physician, or corporation; and the remaining 8 percent are employed by hospitals (Table 2-7). Their employment status varies by their CRNA involvement. Those who employ CRNAs are self-employed and overwhelmingly found in group practices. Anesthesiologists who do not work with CRNAs also tend to be self-employed (84 percent), but this group is dominated by solo practices (64 percent).

Anesthesiologists who supervise but do not employ CRNAs differ substantially from the other two groups. First, they are less often self-employed and more often affiliated with large practices (averaging 28 full-time physicians) about 5 times larger than the employers' practices. Supervisors also tend to be younger and to receive a straight salary or salary plus incentives. In contrast, the predominant financial arrangement among anesthesiologists working alone or employing CRNAs is fee-for-service.

TABLE 2-7

EMPLOYMENT STATUS AND HOSPITAL FINANCIAL ARRANGMENTS OF ANESTHESIOLOGISTS, BY CRNA INVOLVEMENT

	All Anesthesiologists	Work Alone	Supervise CRNAs	Employ CRNAs
Employment Status				
Employed by Hospital	7.6%	4.0%	17.7%	0.0%
Employed by Clinic or HMO	1.9	1.4	4.1	0.0
Employed by Another Physician or Corporation	19.0	10.8	43.6	0.0
Self-Employed	71.5	83.8	34.7	100.0*
Group Practice	(54.6)	(35.9)	(70.0)	(86.7)
Solo Practice	(45.4)	(64.1)	(30.0)	(13.3)
Average Practice Size** (Physician FTEs)	12.2	5.6	28.8	6.3
Hospital financial arrangement				
Salary	10.5%	6.5%	19.7%	5.2%
Salary plus incentives	6.4	4.0	12.0	0.0
Fee-for-service or fixed percent of each charge	80.8	88.0	66.1	93.1
Percent of net department billings	0.3	0.8	0.0	0.0
Percent of gross department billings	0.7	0.0	0.0	1.7
Other financial arrangements	1.3	0.7	2.2	0.0

*By definition, anesthesiologists who employ CRNAs are self-employed.

**Average practice size excludes anesthesiologists who are employed by hospitals.

Source: 1984-85 Physicians' Practice Costs and Income Survey.

Table 2-8 shows the average number of hours worked by anesthesiologists, according to their level of CRNA involvement. Employers work more hours per week at medical and administrative activities combined and at medical activities alone than both supervisors and anesthesiologists working alone. Although all three groups work about 46 weeks per year on average, employers average more hours per year than the other two groups (2,677 vs. 2,560) because of their longer work weeks. Table 2-8 also shows that anesthesiologists who supervise or employ CRNAs are involved in more operations per week, on average, than those who work alone. In fact, supervisors report almost 20 percent more operations per week than those who work alone, while employers report nearly 40 percent more operations.

Table 2-9 compares the average net income of anesthesiologists to the surgical specialists with whom they work, adjusting for geographic variations in the cost of living as well as number of hours worked. In 1983, the average net physician income of $92,000 was exceeded by both anesthesiologists and surgeons. As shown in Table 2-9, anesthesiologists earned 9 percent more than the surgeons with whom they worked ($122,00 vs. $112,000) but worked 8 percent fewer hours per year (2,600 vs. 2,800). Among the three groups of anesthesiologists, employers earn considerably more than the other two groups, with an average net income of $142,000 (Table 2 - 10).

Imputing average hourly wages nets out the effect of differences in the number of hours worked. As shown on Table 2-11, employers realized earnings of $9.69 more per hour if they employ CRNAs rather than if they supervise them. This amounts to roughly $100 more per day that they are in the hospital.

TABLE 2-8

WORK EFFORT OF ANESTHESIOLOGISTS, BY CRNA INVOLVEMENT

	All Anesthesiologists	Work Alone	Supervise CRNAs	Employ CRNAs
Average number of hours worked per week				
Medical and administrative activities combined	55.6	55.1	55.6	58.2
Medical activities only	51.7	50.7	51.5	53.3
Average number of hours* worked per year	2,563	2,559	2,556	2,677
Average number of weeks worked per year	46.1	46.4	46.0	46.1
Locus of care (%)				
Inpatient surgery	69.5	71.9	68.0	69.6
Outpatient surgery	30.7	28.5	32.0	30.4
Role of Anesthesiologist (%)				
Personally administering anesthesia	74.9	100.0	50.9	51.1
Supervising CRNAs	25.1	0.0	49.1	48.8
Average number of hours spent supervising CRNAs	13.1	0.0	25.4	25.2
Percent spending any time supervising residents	16.1	8.9	28.1	12.5
Average number of operations per week	28.3	25.0	29.7	34.5

*Includes medical and administrative activities combined.

Source: 1984-85 Physicians' Practice Costs and Income Survey.

TABLE 2-9

NET INCOMES AND WORK EFFORT: ANESTHESIOLOGISTS VERSUS SURGICAL SPECIALTIES

	Anesthesiology	Surgical Specialties
Average net income* (1983 dollars)	$121,710	$112,053
Average number of hours worked per year	2,563	2,801
Imputed hourly wage**	$51.84	$44.87

*Net income was adjusted for geographic variations in the cost of living. Figures are in 1983 dollars.

**Imputed hourly wage is calculated by dividing net income by the total number of hours worked per year (that is, weeks worked per year times the number of hours worked per week).

Source: 1984-85 Physicians' Practice Costs and Income Survey.

TABLE 2-10

WORK EFFORT AND INCOME OF CERTIFIED REGISTERED NURSE ANESTHETISTS, BY EMPLOYMENT ARRANGEMENT (STANDARD DEVIATION IN PARENTHESES)*

Employment Arrangement	Percent of CRNAs	Average Hours Worked Per Week**	Average Income***	Average Hourly Wage****
All CRNAs	100.0%	38.3 (13.5)	$39,045 (19,008)	$23.32 - $24.31 (18.69 - 19.49)
Employed by hospital/ university	45.8	38.6 (13.7)	37,539 (15,718)	22.56 - 23.52 (17.86 - 18.62)
Employed by MDA/CRNA group	36.3	39.7 (11.4)	36,727 (13,809)	20.93 - 21.82 (15.53 - 16.19)
Freelance	7.2	28.1 (18.5)	60,101 (40,150)	42.98 - 44.81 (27.31 - 28.47)
Employed by CRNA group	3.6	32.4 (13.5)	50,651 (22,471)	35.93 - 37.46 (24.52 - 25.57)
Employed in office, clinic or surgicenter	2.2	36.4 (9.5)	35,869 (13,815)	23.55 - 24.55 (21.03 - 21.92)
Employed by military	3.3	43.2 (10.0)	32,370 (10,294)	16.71 - 17.42 (9.66 - 10.07)
Other arrangement	0.8	39.7 (12.3)	38,106 (14,665)	21.09 - 21.98 (12.37 - 12.90)
Combined arrangement	0.8	39.1 (23.8)	45,693 (27,303)	30.90 - 32.22 (28.11 - 29.30)

* Employment arrangement based on the practice setting for 50 percent or more of the practice. Combined arrangements include practices with no one setting accounting for 50 percent of the practice, or practices divided equally between two settings, each accounting for 50 percent of the practice. This table includes CRNAs in active patient care for at least 20 hours per week.

** Includes only hours worked on a straight shift or on call in the hospital. Excludes on call hours not spent in the hospital.

*** Income in 1984 dollars. Figures have been adjusted for geographic variations in cost of living.

**** Average hourly wages have been imputed by dividing total income by hours worked per year. Because the membership survey did not collect data on weeks not practiced in 1984, hourly wages were imputed under three assumptions (3, 4, and 5 weeks not practiced) to derive a range. These assumptions were based on data from the 1986 Anesthesia Practice Survey, described in Chapter 4.

Source: Fiscal 1986 Membership Survey, American Association of Nurse Anesthetists.

TABLE 2-11

IMPUTED HOURLY WAGE OF ANESTHESIOLOGISTS, BY CRNA INVOLVEMENT AND DEMOGRAPHIC CHARACTERISTICS*

	All Anesthesiologists	Work Alone	Supervise CRNAs	Employ CRNAs
All Anesthesiologists	$51.84 (37.12)**	$52.77 (28.11)	$47.73 (48.31)	$56.88 (39.01)
Age				
Under 40 years	51.90 (34.31)	55.20 (36.14)	43.81 (34.41)	57.24 (28.70)
40 - 59 years	50.32 (36.76)	49.72 (24.24)	50.69 (61.16)	51.26 (13.83)
60 years and over	61.58 (47.75)	58.97 (16.21)	48.71 (12.16)	94.56 (127.60)
Sex				
Male	51.81 (31.53)	53.80 (29.23)	43.55 (26.21)	57.76 (40.55)
Female	54.55 (66.86)	43.98 (13.07)	68.62 (103.96)	46.73 (6.76)
Race				
White	53.44 (40.01)	55.48 (29.02)	46.37 (54.60)	57.10 (41.50)
Non-white	48.39 (27.89)	44.64 (23.77)	50.43 (33.19)	55.89 (26.64)
FMG Status				
Foreign medical graduate	46.51 (24.90)	47.08 (24.35)	45.61 (30.79)	46.74 (7.96)
U.S. medical graduate	55.10 (42.12)	55.58 (29.52)	49.24 (58.01)	60.82 (45.28)
Board-certification status				
Board-certified	54.09 (43.89)	53.07 (30.80)	50.75 (59.57)	60.58 (46.40)
Not board-certified	49.75 (27.10)	52.42 (24.84)	44.34 (31.95)	51.33 (24.20)

*Net income was adjusted for geographic variations in the cost of living. Figures are in 1983 dollars. Imputed hourly wage is calculated by dividing net income by the total number of hours worked per year (that is, weeks worked per year times the number of hours worked per week).

**Standard deviation in parentheses.

Source: 1984-85 Physicians' Practice Costs and Income Survey.

Employment Arrangements and Income of CRNAs

To derive similar measures of annual incomes and hourly wages for CRNAs, a data type was obtained from the AANA containing responses to the fiscal 1986 membership survey. Of the 20,102 AANA members contacted, 16,338 (81.3 percent) returned the survey questionnaries. The sample was limited to CRNAs involved in patient care for at least 20 hours per week. Hours worked per week included only hours worked in a straight shift or hours spent on call in the hospital.

On the AANA survey, CRNAs reported gross salary/income, prior to any deductions for practice costs. The reported incomes were adjusted to account for geographic variations in cost of living. In imputing hourly wages, a range of incomes under three alternate assumptions was devised, namely 3, 4, and 5 weeks not practiced in 1984.*

CRNAs were classified according to the employment arrangement in which they spent 50 percent or more of their practice. Where a CRNA's time was divided equally between two settings or in more than two settings with no one setting accounting for at least 50 percent, it was called a "combined arrangement."

*Data from the Anesthesia Practice Survey (See Chapter 4) showed that 16 percent of CRNAs had 3 weeks leave in 1985, 28 percent had 4 weeks leave, and 20 percent had 5 weeks leave—acounting for 64 percent of the CRNAs interviewed.

Table 2-12 presents the results of the analysis of the employment arrangements, work effort, and income of CRNAs. Slightly less than half of CRNAs in active patient care for at least 20 hours per week were employed by a hospital or university. Another third were employed in a group consisting of anesthesiologists and CRNAs. About 7 percent of CRNAs had freelance arrangements. The remainder were employed by a CRNA group (4 percent), employed in an office, clinic, or surgicenter (2 percent), employed by the military (3 percent), or had some other arrangement or combination of arrangements (2 percent).

Over the past decade the relative position of these various arrangements has not changed. What has changed is that the dominance of hospital employment has eroded and anesthesiologist/CRNA groups have become more common. According to the 1975 membership survey, 69 percent of CRNAs were hospital employees and 20 percent were employed by anesthesiologist/CRNA groups (Goff, 1975).

On average, CRNAs earned a gross income of $39,000 and worked 38 hours per week. Freelance CRNAs worked the fewest hours, 28 hours per week, while those in the military averaged 43 hours per week. Incomes ranged from $32,400 for military personnel to $60,100 for freelance CRNAs. The two largest groups--employees of hospitals and anesthesiologist/CRNA practices--earned an average of $37,000 and worked an average of 39-40 hours per week.

Looking at imputed hourly wages, average CRNA earnings ranged from $23.30 to $24.30 (exclusive of fringes). As would be expected from their high incomes and relatively low number of hours worked, freelance CRNAs enjoyed by far the highest hourly wages ($43.00 - $45.00). Since these estimates are based on gross

TABLE 2-12

WORK EFFORT AND INCOME OF CERTIFIED REGISTERED NURSE ANESTHETISTS, BY EMPLOYMENT ARRANGEMENT (STANDARD DEVIATION IN PARENTHESES)*

Employment Arrangement	Percent of CRNAs	Average Hours Worked Per Week**	Average Income***	Average Hourly Wage****
All CRNAs	100.0%	38.3 (13.5)	$39,045 (19,008)	$23.32 - $24.31 (18.69 - 19.49)
Employed by hospital/ university	45.8	38.6 (13.7)	37,539 (15,718)	22.56 - 23.52 (17.86 - 18.62)
Employed by MDA/CRNA group	36.3	39.7 (11.4)	36,727 (13,809)	20.93 - 21.82 (15.53 - 16.19)
Freelance	7.2	28.1 (18.5)	60,101 (40,150)	42.98 - 44.81 (27.31 - 28.47)
Employed by CRNA group	3.6	32.4 (13.5)	50,651 (22,471)	35.93 - 37.46 (24.52 - 25.57)
Employed in office, clinic or surgicenter	2.2	36.4 (9.5)	35,869 (13,815)	23.55 - 24.55 (21.03 - 21.92)
Employed by military	3.3	43.2 (10.0)	32,370 (10,294)	16.71 - 17.42 (9.66 - 10.07)
Other arrangement	0.8	39.7 (12.3)	38,106 (14,665)	21.09 - 21.98 (12.37 - 12.90)
Combined arrangement	0.8	39.1 (23.8)	45,693 (27,303)	30.90 - 32.22 (28.11 - 29.30)

* Employment arrangement based on the practice setting for 50 percent or more of the practice. Combined arrangements include practices with no one setting accounting for 50 percent of the practice, or practices divided equally between two settings, each accounting for 50 percent of the practice. This table includes CRNAs in active patient care for at least 20 hours per week.

** Includes only hours worked on a straight shift or on call in the hospital. Excludes on call hours not spent in the hospital.

*** Income in 1984 dollars. Figures have been adjusted for geographic variations in cost of living.

**** Average hourly wages have been imputed by dividing total income by hours worked per year. Because the membership survey did not collect data on weeks not practiced in 1984, hourly wages were imputed under three assumptions (3, 4, and 5 weeks not practiced) to derive a range. These assumptions were based on data from the 1986 Anesthesia Practice Survey, described in Chapter 4.

Source: Fiscal 1986 Membership Survey, American Association of Nurse Anesthetists.

incomes, however, estimates for freelance CRNAs undoubtedly include certain practice expenses and fringe benefits that might otherwise be paid by an employer in lieu of salary. Military employees, at the other extreme, earn only $17 an hour, on average. Living expenses covered by the military in lieu of salary, however, are not reflected in these estimates.

For the two largest groups, the average hourly wage is about $23 for hospital employees and about $21 for CRNAs in anesthesiologist/CRNA group. Thus, CRNAs in a group practice earn 7 percent less for every hour worked, compared to those employed by hospitals. These comparisons do not take into account fringe benefits nor any systematic differences in the urban/rural location of CRNAs employed by hospitals versus groups.

Summary

Based on existing secondary data, the practice patterns of anesthesia providers in the U.S., both at the hospital level and at the provider level, were examined, and an overview was given of the geographic distribution of CRNAs and anesthesiologists.

Of particular interest is the relative financial position of the two types of anesthesia providers. CRNAs are shown to be relatively less expensive than anesthesiologists, both in terms of annual incomes and imputed hourly wages. The hourly wage ratio of CRNAs to anesthesiologists is .46. When the average hourly

wage of anesthesiologists that employ CRNAs ($56.88) was compared to that of CRNAs employed by anesthesiologists ($21.38), the hourly wage ratio falls to .38. It should be pointed out that in this analysis the incomes and hourly wages for CRNAs are in 1984 dollars, while the figures for anesthesiologists are in 1983 dollars. Deflating CRNA incomes and hourly wages to 1983 dollars would magnify the difference even more.

From a policy perspective, it simply is not enough to compare the incomes and hourly wages of the two provider groups. While their relative wage rates indicate that CRNAs are less expensive, these data do not address other issues related to the substitutability of CRNAs for anesthesiologists, such as: relative productivity, division of labor, task complexity, and supervision intensity. The next two chapters address these issues using data from a national survey of CRNAs and anesthesiologists.

CHAPTER 3

USUAL ACTIVITIES OF CRNAs AND ANESTHESIOLOGIST: RESULTS FROM THE 1986 ANESTHESIA PRACTICE SURVEY

In the previous chapter it was found that the average hourly wage of CRNA's is approximately one-half that of anesthesiologists. On the surface, therefore, CRNAs appear to be relatively less expensive than anesthesiologists. However, this information alone is not enough to evaluate alternate payment options. What is needed, in addition, is information on the degree to which CRNAs substitute for anesthesiologists in performing the entire anesthesia procedure for a given surgical operation.

Since such information is not known to be available from any existing secondary source, CHER, in conjunction with AIR, designed and conducted a national survey of CRNAs and anesthesiologists to gather information on the usual activities of the two provider groups. Data from the 1986 Anesthesia Practice Survey presented in this chapter focus on the usual activities of CRNAs and anesthesiologists and on baseline information regarding their employment and payment arrangements, hospital affiliations, and work effort. Chapter 4 presents the patient-level information from the survey with the intent of describing case mix differences between the two groups, the nature of supervision provided by anesthesiologists and the substitutability of CRNAs for anesthesiologists on selected procedures.

Data and Methods

The main Anesthesia Practice Survey began in early September and was completed in the beginning of November 1986. Data were gathered during telephone interviews averaging 25 minutes in length.

Separate proportional random samples of CRNAs and anesthesiologists were drawn, each stratified by region and urban/rural location. For the sample of CRNAs, CHER obtained a tape from Resources, Inc., listing members of the AANA who were in active patient care and linked it to geographic indicators. A sample of 835 CRNAs was then drawn from this linked file.

The anesthesiologist sample for the main survey was drawn by the AMA from their Physician Masterfile. The resulting sample of 1000 anesthesiologists was limited to active, non-Federal, patient care physicians with primary speciality of anesthesiology. CHER replicated the AMA sampling procedure to produce two subsamples of 793 and 196 anesthesiologists, for a total of 989 cases. The subsamples were fielded in two separate waves.

Overall, 520 CRNAs and 529 anesthesiologists were interviewed in the main survey. Completion rates of those eligible to participate were 94 percent for CRNAs and 79 percent for anesthesiologists. It should be noted, moreover, that only hospital practitioners are included in this analysis. Information was gathered on the employment and payment arrangements of CRNAs and anesthesiologists, their typical daily activities, and the patients they treated during the previous 24 hours.

Hospital Affiliations

Of the 488 CRNAs included in this analysis, 90 percent reportedly worked in settings with anesthesiologists, while only 10 percent worked in settings with no anesthesiologists (Table 3-1). Among the 511 anesthesiologists, 72 percent worked in settings with CRNAs, while one-fourth worked alone.* Of the 370 anesthesiologists who reported there are CRNAs in their practice, nearly half (46.5 percent) employ the CRNAs in their practice, while the remainder (53.5 percent) supervise CRNAs who are employed under another arrangement.

The type of anesthesia practice arrangement varies according to hospital characteristics, as shown in Table 3-2. CRNAs who work alone are more likely than those who work with anesthesiologists to be affiliated with public (non-Federal) or private (not-for-profit) hospitals, averaging less than 100 beds, with an occupancy rate barely above 50 percent, with fewer than four surgical operations per day, and relatively little in the way of specialized care, particularly in obstetrics. Slightly more than half are accredited by the JCAH.

*It might be recalled from Chapter 2 that the 1984-85 PPCIS estimated a lower rate of CRNA involvement (half of all anesthesiologists worked alone, 19 percent employed CRNAs, and 31 percent supervised CRNAs employed by others) possibly reflecting changing employment trends or methodological differences between the two surveys. This may lead to a slight overestimate of actual CRNA involvement.

TABLE 3-1

DISTRIBUTION OF CRNAs AND ANESTHESIOLOGISTS, BY ANESTHESIA PRACTICE ARRANGEMENT

	Number*	Percent of Total
CRNAs (Total)	488	100.0%
Working alone	49	10.0
Working with anesthesiologist(s)	439	90.0
Anesthesiologists (Total)	511	100.0%
Working alone	141	27.6
Working with CRNA(s)	370	72.4
Employs CRNA(s)	172	(46.5)
CRNA(s) employed by other arrangement	198	(53.5)

*Excludes respondents who participated in the pilot survey as well as providers without a hospital affiliation. See text for details.

Source: CHER Anesthesia Practice Survey.

TABLE 3-2

HOSPITAL AFFILIATION OF CRNAs AND ANESTHESIOLOGISTS

Hospital Characteristics	CRNAs		MDAs	
	Alone	With MDAs	Alone	With CRNAs
Ownership				
Public, nonfederal	36.7%	14.4%	7.8%	11.4%
Private, not for profit	40.8	74.5	83.0	77.6
Investor-owned	16.3	6.8	9.2	8.9
Federal	6.1	4.3	0.0	2.2
Bedsize				
6-49 beds	20.4	1.8	3.6	0.3
50-199 beds	69.4	29.2	33.3	22.4
100-399 beds	6.1	34.9	41.8	31.9
400 or more beds	4.1	34.2	21.3	45.4
Average number of beds	95	351	288	428
JCAH Accreditation	55.1	95.9	99.3	97.0
Percent with Medicare Certification	93.9	92.7	98.6	94.9
Hospital Occupancy Rate (average)	56.1	71.5	68.6	72.2
Surgical Operations per Week (Average)				
Inpatient	14	112	95	137
Outpatient	4	46	40	54
Total	18	158	135	191

This is in marked contrast to the profile of hospitals in which anesthesiologists work alone. Most are privately operated and not-for profit, average just under 300 beds, virtually all are accredited by JCAH, with an occupancy rate averaging about two-thirds, and performing an average of 27 operations per day. The services in those hospitals are relatively sophisticated in terms of specialized care.

The hospitals of CRNAs and anesthesiologists that work together are also predominantly not-for-profit, but they are considerably larger on average (a sizable proportion have 400 or more beds). Virtually all are JCAH-accredited, and the occupancy rate exceeds 70 percent. The surgical workload is the heaviest, and the services are the most sophisticated in those hospitals.

Despite these sharp differences in hospital profiles, two commonalties occur across practice type: most hospitals are Medicare certified (93-99 percent) and about 28-30 percent of all surgeries are performed on an outpatient basis.

Geographic Location

Table 3-3 presents geographic variations at the provider level. CRNAs who work alone are predominantly affiliated with hospitals in rural areas. Among anesthesiologists, however, a relatively greater proportion of those working with CRNAs are in areas with a population of 500,000 to 1,000,000, while those working alone are relatively more likely to be in the largest population areas (over 1,000,000 population).

TABLE 3-3

LOCATION* OF CRNAs AND ANESTHESIOLOGISTS

	CRNAs		MDAs	
	Alone	With MDAs	Alone	With CRNAs
Rural	83.7%	19.4%	12.1%	11.6%
Urban				
Under 100,000 population	0.7	1.6	2.1	4.3
100,000 to 500,000 pop.	10.2	29.4	22.7	21.6
500,000 to 1,000,000 pop.	4.1	16.4	9.9	18.4
Over 1,000,000 pop.	2.0	33.3	53.2	44.1
Census Division				
New England	0.0	8.4	5.0	8.1
Middle Atlantic	2.0	14.4	9.9	19.5
South Atlantic	8.2	19.6	7.8	14.6
East South Central	20.4	8.2	1.4	3.2
West South Central	20.4	11.9	5.0	15.7
East North Central	12.2	17.8	17.0	15.4
West North Central	28.6	11.2	2.1	8.9
Mountain	4.1	2.5	14.2	3.5
Pacific	4.1	6.2	37.6	11.1

*Based on location of hospital.

Source: CHER Anesthesia Practice Survey.

In terms of regional patterns, CRNAs working alone are disproportionately located in the East South Central, West South Central, and West North Central States. The team concept is most prevalent on the East Coast while on the West Coast (in the Pacific States), anesthesiologists tend to work alone.

Employment and Payment Arrangements

Table 3-4 presents the employment and payment arrangements of CRNAs and anesthesiologists according to their practice arrangement. CRNAs who work alone are either employed by the hospital/university (49 percent) or self-employed (49 percent), whereas the CRNAs who work with anesthesiologists tend to be hospital employees (46 percent) or employed by a physician practice (42 percent).

A higher proportion of CRNAs working alone are paid on a fee-for-service basis (40 percent) or receive a salary with additional incentive payments, such as a bonus or profit sharing (46 percent), while CRNAs working with anesthesiologists are mostly paid a straight salary (63 percent) and only 4 percent are paid on a fee-for-service basis. Among anesthesiologists, three-fourth of those who work alone are paid on a fee-for-service basis versus about half of the anesthesiologists working with CRNAs.

Table 3-4 also shows the average number of anesthesia providers in the hospitals where CRNAs and anesthesiologists spent their most recent shift. CRNAs who "work alone" are in hospitals with only two CRNAs on average. In contrast, CRNAs who work with anesthesiologists are part of much larger anesthesia staffs, averaging

TABLE 3-4

EMPLOYMENT, PAYMENT AND STAFFING ARRANGEMENTS OF CRNAs AND ANESTHESIOLOGISTS

	CRNAs		MDAs	
	Alone (n=49)	With MDAs (n=439)	Alone (n=141)	With CRNAs (n=370)
Employment Arrangements				
Employed by hospital/ university	49.0	46.0	5.7	13.2
Employed by physician group	0.0	42.1	5.0	11.4
Self-employed	49.0	5.7	87.2	72.2
Other*	2.0	6.2	2.1	3.2
Payment Arrangements				
Straight salary	8.3	62.2	4.3	17.8
Salary plus incentives	45.8	20.7	10.6	19.7
Fee-for-service	39.6	3.6	78.0	55.7
Hourly	0.0	11.4	1.4	0.3
Other**	6.3	2.1	5.7	6.5
Anesthesia Staffing***				
Average number of:				
CRNAs	2.3	12.2	0.0	9.7
MDAs	0.0	7.8	14.5	13.9
Percent with anesthesia residents	0.0	12.3	10.1	23.0
Average number of anesthesia residents (if any)	0.0	11.3	10.7	19.1
Percent with separate anesthesia departments	73.5	83.8	75.9	82.9
Percent with MDAs available on call 24 hours a day	6.3	91.8	100.0	95.9

*Includes employment in organized settings such as military, HMO, clinic or surgicenter.

**Includes combined payment arrangements, per diem, hourly plus incentives, percent of net/gross department billings, and fee-for-service with incentives.

***This represents the average number of providers in the hospitals, not necessarily in the respondent's practice.

Source: CHER Anesthesia Practice Survey.

12 CRNAs and anesthesiologists. Anesthesiologists, whether they work alone or with CRNAs are in hospitals averaging 14 anesthesiologists.

Work Effort

Annualized measures of work effort were derived to provide baseline measures of the productivity of CRNAs and anesthesiologists. It was found CRNAs who practice alone work an average of 37 hours per week (versus 42 hours for CRNAs working in a team with anesthesiologists) but work an average of 1 more week per year (48 vs. 47). (Table 3-5.) However, both groups of CRNAs work fewer hours per week and per year than anesthesiologists, regardless of practice arrangement.

Another measure of productivity is the number of anesthesias per year, CRNAs working alone are involved in 27 percent fewer anesthesias per year than are CRNAs who work with anesthesiologists. Across the board, anesthesiologists are involved in more anesthesias than CRNAs but the difference is particularly greater between the anesthesiologists working in a team versus all other groups. Averaging nearly 1,500 anesthesias per year, they are involved in twice as many anesthesias as CRNAs working alone, 43 percent more than CRNAs also working in a team, and 34 percent more than their anesthesiologist colleagues who work alone.

Finally, it would appear that the team approach results in a proportionately greater amount of CRNA time spent in operating room activities, while CRNAs working alone must also perform administrative functions and other nonoperating room activities.

TABLE 3-5

WORK EFFORT OF CRNAs AND ANESTHESIOLOGISTS

	CRNAs		MDAs	
	Alone	With MDAs	Alone	With CRNAs
Average number of hours worked:				
Per week	36.6	41.6	50.3	52.5
Per year	1,743.3	1,953.2	2,341.4	2,433.3
Average number of weeks not practiced in 1985	4.0	5.1	5.5	5.7
Average number of operations:				
Per week	14.4	20.0	21.5	28.9
Per year	684.3	942.7	1,001.7	1,345.7
Average time spent providing anesthesia:				
Percent of total hours	77.5%	80.6%	77.5%	77.9%
Hours per week	27.6	33.6	38.7	40.4
Hours per year	1,322.0	1,576.2	1,801.0	1,875.6

Source: CHER Anesthesia Practice Survey.

Anesthesia Tasks

As part of the 1986 Anesthesia Practice Survey, summary information was collected on the frequency with which CRNAs and anesthesiologists performed nine selected anesthesiology service tasks, roughly divided into two categories:

a) tasks performed during the pre- and postoperative periods, and

b) tasks performed intraoperatively.

CRNAs and anesthesiologists were asked to report the frequency with which they "personally perform" these selected tasks "when they are required."

As can be seen in Table 3-6 and in Figure 3-1, anesthesiologists, whether working alone or with CRNAs, are in every case more likely to usually or always perform these nine tasks than CRNAs. Of the nine tasks, both groups were more likely than not to classify and assign patient risk factors (89 percent of anesthesiologists and 51 percent of CRNAs) or discuss the anesthesia care plan with the patient or family (84 percent vs. 61 percent).

About two-thirds of anesthesiologists, but less than one-third of CRNAs, regularly administer regional blocks, a controversial issue for both professional associations. The placement of invasive monitoring devices is another controversial area. While 36 percent of CRNAs regularly insert arterial lines, only 6 percent insert CVP lines, and 4 percent insert Swan-Ganz catheters. By comparison, among anesthesiologists, 57 percent regularly insert arterial lines, 55 percent insert CVP lines, and 44 percent insert Swan-Ganz catheters.

TABLE 3-6

PERCENT OF PROVIDERS USUALLY OR ALWAYS PERFORMING SELECTED PRE- AND POSTOPERATIVE TASKS, BY PROVIDER CHARACTERISTICS*

	Evaluate Risk Factors		Discuss Plan with Patient		Obtain Informed Consent		Evaluate Patient in Recovery	
Provider Characteristics	CRNAs	MDAs	CRNAs	MDAs	CRNAs	MDAs	CRNAs	MDAs
Practice Arrangement								
Both MDAs and CRNAs	46.2%	85.9%	57.0%	80.2%	18.7%	51.0%	40.1%	82.6%
MDAs only	--	96.5	--	93.6	--	63.1	--	94.3
CRNAs only	95.8	--	93.9	--	38.8	--	89.8	--
Employment Arrangements								
Employed by hospital or university	48.4%	50.0%	57.5%	39.7%	14.6%	22.4%	43.4%	57.9%
Employed by MD group	40.5	87.8	54.1	89.8	20.5	60.4	34.1	79.6
Self-employed	87.8	94.9	85.7	90.5	42.9	58.3	83.7	90.7
Other employer	78.6	80.0	85.7	66.7	32.1	53.3	64.3	86.7
Payment Arrangements								
Straight salary	49.7	71.2	59.7	58.3	20.3	36.1	43.4	70.8
Salary plus incentives	48.4	81.8	56.8	73.9	16.8	54.6	34.7	79.6
Fee-for-service	85.7	94.6	85.7	92.1	45.7	60.1	85.7	91.4
Hourly	40.0	100.0	52.0	100.0	14.0	33.3	40.0	100.0
Other	50.0	87.5	75.0	87.5	16.7	57.1	66.7	81.3
Years of Experience								
0-5 years	50.9	93.9	62.9	90.9	19.0	60.6	47.4	93.9
6-10 years	59.5	85.3	63.9	82.6	27.1	49.5	48.4	81.7
11-20 years	48.1	89.7	59.0	80.5	18.0	54.1	45.5	88.4
21-30 years	44.3	90.6	57.1	88.0	15.7	57.8	37.1	89.7
31 or more years	50.0	85.7	54.2	84.0	29.2	53.2	37.5	76.6
Type of Degree								
Certificate	49.5	--	58.7	--	20.4	--	44.6	--
Academic degree	63.2	--	75.4	--	22.8	--	49.1	--
Board Certification								
Board certified	--	86.9	--	82.6	--	51.0	--	79.6
Not board certified	--	91.0	--	90.0	--	58.4	--	89.6

*Survey participants were asked how often they personally performed the task when it was performed.

TABLE 3-6(continued)

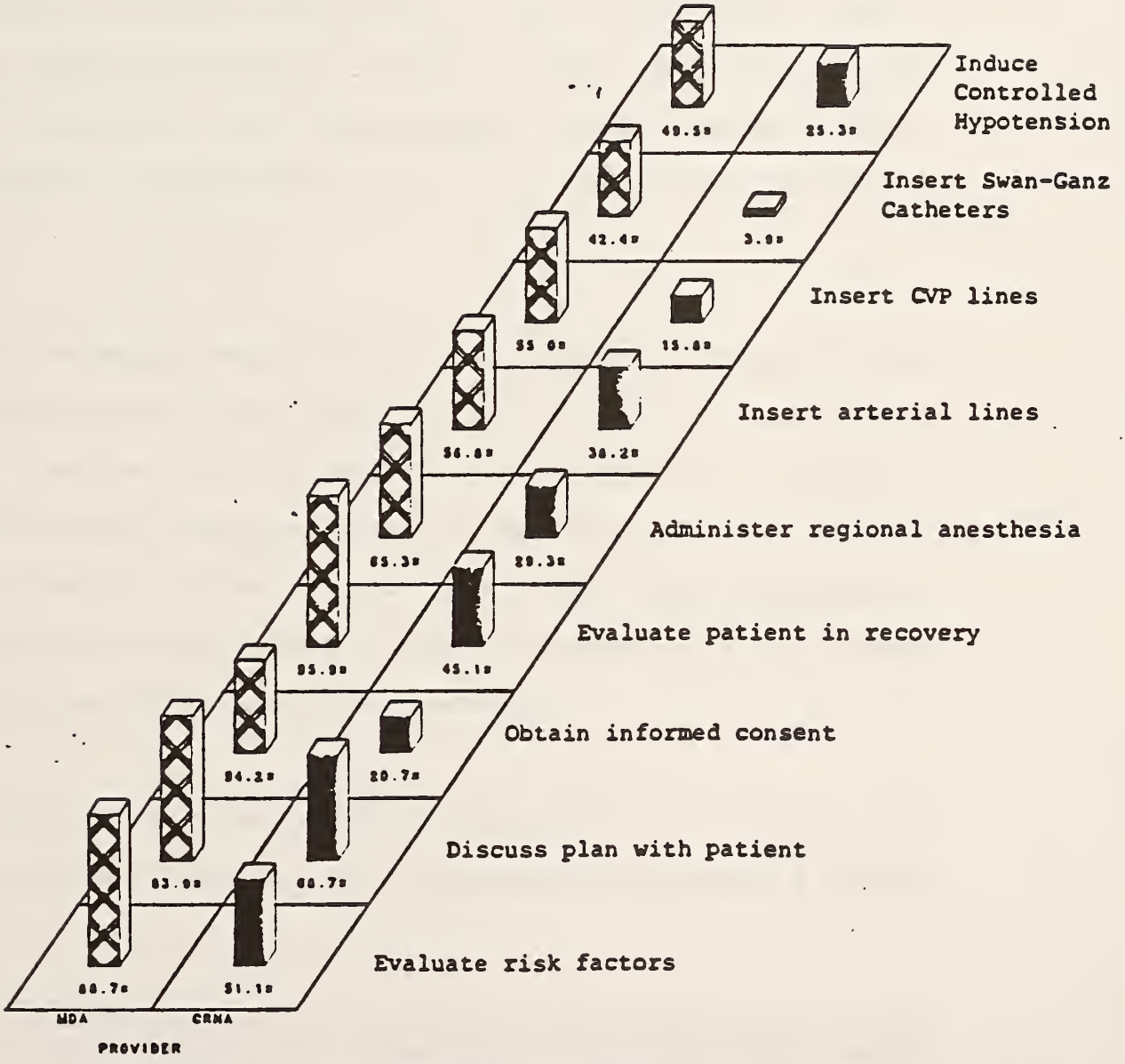
PERCENT OF PROVIDERS USUALLY OR ALWAYS PERFORMING SELECTED INTRAOPERATIVE TASKS, BY PROVIDER CHARACTERISTICS[a]

Provider Characteristics	Administer Regional Blocks		Insert Arterial Lines		Insert CVP Lines		Insert Swan-Ganz Catheter		Induce Controll Hypotension	
	CRNAs	MDAs	CRNAs	MDAs	CRNAs	MDAs	CRNAs	MDAs	CRNAs	MDAs
Practice Arrangement										
Both MDAs and CRNAs	26.3	65.3	35.8	57.0	14.4	56.9	4.1	44.7	26.4	49.1
MDAs only	--	66.0	--	56.0	--	50.4	--	36.9	--	51.1
CRNAs only	57.1	--	38.8	--	26.5	--	2.0	--	14.3	--
Employment Arrangements										
Employed by hospital or university	26.2	19.0	36.0	15.5	13.7	17.2	2.7	15.5	20.4	22.8
Employed by MD group	23.2	67.3	35.1	53.1	28.6	55.1	5.4	46.9	28.7	51.0
Self employed	49.0	71.7	32.7	63.1	14.6	59.9	4.1	45.8	26.5	52.8
Other	60.7	73.3	50.0	60.0	20.4	73.3	3.6	46.7	39.3	60.0
Payment Arrangements										
Straight salary	28.9	42.5	36.4	38.4	15.3	42.5	4.8	39.7	23.4	34.7
Salary plus incentives	25.3	64.8	32.6	48.9	14.7	58.0	3.2	45.5	24.2	52.3
Fee-for-service	54.3	69.8	31.4	62.0	25.7	56.2	0.0	40.6	22.9	51.3
Hourly	20.0	100.0	40.0	100.0	8.0	66.7	0.0	0.0	34.0	66.7
Other	41.7	71.9	50.0	62.5	33.3	62.5	16.7	62.5	50.0	56.3
Years of Experience										
0-5 years	38.3	69.7	53.0	60.6	28.2	60.6	7.8	54.5	31.0	51.5
6-10 years	30.3	60.6	44.3	60.2	15.6	61.5	4.1	54.1	33.6	56.0
11-20 years	30.1	65.1	29.5	58.9	10.9	60.6	3.2	50.9	22.4	52.0
21-30 years	17.1	68.4	17.1	55.6	8.6	52.1	0.0	32.5	12.9	45.3
31 or more years	12.5	66.2	12.5	46.1	4.2	35.1	0.0	16.9	8.3	39.5
Type of Degree										
Certificate	27.8	--	32.6	--	13.7	--	3.9	--	23.7	--
Academic degree	41.1	--	63.2	--	29.8	--	3.5	--	36.8	--
Board Certification										
Board certified	--	64.1	--	55.6	--	56.2	--	46.9	--	50.3
Not board certified	--	67.0	--	57.9	--	53.4	--	36.7	--	48.4

[a]Survey participants were asked how often they personally performed the task when it was performed.

FIGURE 3-1

PERCENT OF CRNAS AND MDAS
USUALLY OR ALWAYS PERFORMING SELCTED TASKS



SOURCE: 1986 ANESTHESIA PRACTICE SURVEY

In the final task, inducing controlled hypotension which is a relatively rare and delicate procedure, anesthesiologists are twice as likely to perform the procedure (50 percent vs. 25 percent).

Provider Characteristics

CRNAs who work alone are far more likely than CRNAs who work with anesthesiologists to regularly perform all of the pre- and postoperative tasks, to administer regional anesthesia, and to insert CVP lines. Simply stated, when a CRNA works alone, there is no other anesthetist to perform the task. When a CRNA works with an anesthesiologist, it is often the anesthesiologist that performs the task.

Among anesthesiologists, those working alone are more likely to regularly perform the pre- and postoperative tasks compared to the anesthesiologists who work with CRNAs. Therefore, some of the pre- and postoperative evaluation in CRNA/anesthesiologist settings apparently is delegated to CRNAs or anesthesia resident. However, with regard to the intraoperative tasks, both groups of anesthesiologists are equally as likely to administer regional blocks, insert invasive monitoring devices, and induce controlled hypotension.

Other patterns appear across provider characteristics. For example, both anesthesiologists and CRNAs that are self-employed or employed by a physician

Chi-square test have been conducted to determine whether significant differences exist across provider characteristics. Unless otherwise indicated, all differences are significant at the .05 level.

practice are far more likely to obtain informed consent than are anesthesiologists and CRNAs employed by a hospital. CRNAs employed by hospitals, however, are more likely than those employed by a physician practice to perform the other three pre- and postoperative functions. Conversely, anesthesiologists employed by hospitals or universities, as well as those who are salaried, are less likely than other anesthesiologists to perform the selected pre- and postoperative tasks, perhaps because they delegate these activities to CRNAs or to residents

CRNAs who have entered the profession within the last 20 years appear to have more responsibility than their older colleagues in the more sophisticated tasks, a relationship also found among anesthesiologists where years of experience is inversely associated with some of these tasks, notably the invasive monitoring techniques and induction of controlled hypotension. There are no significant differences between board-certified and nonboard-certified anesthesiologists. However, it is possible that hospital and provider case mix are confounding the above relationships as might be the case with bed size occupancy rate. and surgical volumes.

Summary

This chapter has presented preliminary results from the 1986 Anesthesia Practice Survey on the employment and payment arrangements, geographic location, hospital affiliations, work effort, and usual activities of CRNAs and anesthesiologists, according to their practice arrangements. It has highlighted the differences absent of case mix adjustments between CRNAs and anesthesiologists who work alone versus those who work in a team. The CRNAs working alone tend to be located in rural areas, affiliated with hospitals with fewer than 100 beds, low occupancy rates,

very light surgical workloads, and few sophisticated services. They tend to be self-employed or hospital-employed, paid on a fee-for-service or salaried basis. The CRNAs who work with anesthesiologists are in much larger hospitals in urban areas, the hospitals have higher occupancy rates and heavier surgical workloads and provide more sophisticated services. They are most likely to be hospital employees or employed by a physician practice on a salaried basis.

CRNAs working alone are far more likely to perform pre- and postoperative tasks and to administer regional blocks than CRNAs who work with anesthesiologists. On the other hand, anesthesiologists who work alone are somewhat more likely than anesthesiologists working with CRNAs to perform these tasks. Taken together, these results suggest that CRNAs are substituting for anesthesiologists in hospitals where anesthesiologists are not available but in general, delegation of pre- and post-operative activities to CRNAs is substantially constrained in the presence of anesthesiologists. The quality implications of these and other practices remain unmeasured.

CHAPTER 4

COMPARISON OF CASE MIX OF CRNAs AND ANESTHESIOLOGISTS: RESULTS OF THE 1986 ANESTHESIA PRACTICE SURVEY

This chapter describes the patient-level information collected in the 1986 Anesthesia Practice Survey for all cases on a sample day. It compares the surgical case mix of anesthesiologists and CRNAs, differentiating cases where the two provider types work independently and where they work together. Discussed are the survey findings on patient characteristics across surgeries and within selected types of surgical procedures, type of anesthetic technique performed, and the extent of CRNA supervision by anesthesiologists and surgeons, controlling for the patient's pre-operative physical status.

Data and Methods

Respondents to the 1986 Anesthesia Practice Survey were asked to report on the characteristics of their cases during their most recent shift which must have been completed within 48 hours prior to the interview. A variety of data elements were collected for each patient seen during the sample day. The first step in conducting the analysis was to construct an analytic variable reflecting the anesthesia provider type: CRNA only, anesthesiologist only, and anesthesiologist and CRNA together. Using only these three categories, the adjusted total number of cases included in this analysis was 3,791 cases.

Surgical and Patient Case mix

A comparison of case mix between anesthesiologists and CRNAs must take into account both within-procedure and across-procedure differences. To quantify across-procedure complexity differences, "complexity units" comprised of base value units plus modifier units were assigned to each procedure. For the purposes of this analysis, bases units from the Medicare carrier in New Jersey (1983 version) were used. Two types of modifier units were included: one for extremes of patient age (less than 1 year old or greater than 70) and another for poor physical status.

Several approaches were used to explore procedure complexity differences by provider type. First, the "top-20" procedures, many of which are high volume Medicare procedures, were examined to ascertain whether there are systematic differences in the caseloads of the three provider groups. Table 4-1 shows the 20 procedures accounting for about two-thirds of the CRNA-only cases and about half of the anesthesiologist/CRNA and anesthesiologist-only cases. The three groups appear to concentrate about equally on the least complex cases whereas at the extreme level of complexity, no CABG cases in our sample were performed by a CRNA working alone.

Table 4-2 highlights in greater detail complexity differences across the three groups. On average, CRNAs performed significantly less complex procedures, with an average complexity of 5.18 versus 5.84 and 5.86, for the anesthesiologist/CRNA and anesthesiologist-only cases, respectively. Separating out the obstetric cases, CRNAs predominately focus on vaginal deliveries while cases involving an anesthesiologist are primarily Caesarean-sections.

TABLE 4-1

PROCEDURE MIX, BY TYPE OF ANESTHESIA PROVIDER

Procedure	Average Complexity*	CRNA Only		MDA & CRNA		MDA Only	
		Percent of Total	Cumulative Percent	Percent of Total	Cumulative Percent	Percent of Total	Cumulative Percent
Breast biopsy	3.3	1.0%	--	1.9%	--	1.6%	--
D & C	3.4	6.4	7.4%	4.2	6.1%	4.8	6.4%
Knee arthroscopy	3.7	2.7	10.1	3.4	9.5	3.2	9.6
Cystoscopy	3.9	4.4	14.5	3.6	13.1	3.3	12.9
Vaginal delivery	4.1	11.6	26.1	1.5	14.6	2.4	15.2
Myringotomy	4.6	1.6	27.7	0.9	15.6	2.0	17.2
Hernia repair	4.7	3.8	31.5	3.8	19.4	3.9	21.1
Tonsillectomy	5.0	1.0	32.5	2.2	21.6	2.5	23.5
Cataract procedures	5.1	5.7	38.2	6.2	27.9	5.1	28.6
Laparoscopy	6.0	6.1	44.3	4.2	32.1	3.2	31.8
Appendectomy	6.1	3.1	47.4	1.0	33.1	1.1	32.9
Caesarean-section	6.1	5.5	52.9	4.6	37.7	4.9	37.8
Hysterectomy	6.2	3.7	56.6	4.1	41.8	3.6	41.4
Transurethral resection of prostrate	6.3	2.3	58.9	2.5	44.2	1.1	42.5
Bronchoscopy	6.9	0.9	59.7	0.9	45.1	0.9	43.4
Cholecystectomy	7.7	4.5	64.3	3.0	48.1	3.0	46.5
Laminectomies	9.1	0.4	64.7	2.1	50.2	2.0	48.5
Major joint procedures	10.8	0.9	65.5	1.9	52.1	2.0	50.6
Artery/vein procedures	11.2	0.3	65.8	2.2	54.3	1.8	52.4
Coronary artery bypass graft	21.8	--	65.8	1.6	55.9	1.4	53.8
Residual	--	34.2	100.0	44.1	100.0	46.2	100.0

*Average complexity refers to the average number of base units plus modifiers assigned to the selected procedures. Average complexity is not presented for the residual procedures because of the wide range of procedures included in this category.

TABLE 4-2

COMPLEXITY OF PROCEDURES, BY TYPE OF ANESTHESIA PROVIDER

Procedure Complexity*	CRNA Only (n=707)	MDA & CRNA (n=1,792)	MDA Only (n=1,220)
All procedures			
3 (Least complex)	19.2%	19.9%	19.7%
4	24.9	18.6	19.7
5	11.9	13.2	13.3
6	27.3	23.9	23.3
7	7.2	9.9	9.4
8	4.4	4.6	4.5
9	2.4	1.9	2.2
10	1.3	1.6	1.8
11	0.6	1.3	1.1
12	0.4	1.0	1.1
13	0.1	0.6	0.3
14	--	0.4	0.1
15	--	0.3	0.2
16	0.3	0.3	0.3
17	--	0.3	0.4
18	--	0.2	--
19	--	--	0.1
20	--	0.1	0.3
21	--	0.8	0.9
22	--	0.9	0.7
>23 (Most complex)	--	0.3	0.6
Average complexity	5.18**	5.84	5.86
Obstetric procedures			
4	61.2	24.8	30.3
5	4.1	--	1.1
6	31.4	65.1	67.4
7	1.7	8.3	1.1
8	--	1.8	--
>9	1.7	--	--
Average complexity	4.80**	5.62	5.39

*Procedure complexity reflects the number of base units assigned to a procedure plus modifiers that take into account extremes of age (<1, >70) and poor physical status (ASA status = 3,4, or 5).

**Significantly different from mean for MDAs only ($p < .05$).

Source: CHER Anesthesia Practice Survey.

TABLE 4-2 (continued)

COMPLEXITY OF PROCEDURES, BY TYPE OF ANESTHESIA PROVIDER

Procedure Complexity*	CRNA Only (n=707)	MDA & CRNA (n=1,792)	MDA Only (n=1,220)
Non-obstetric procedures			
3	23.2	21.2	21.2
4	17.3	18.2	18.9
5	13.6	14.1	14.3
6	26.2	20.8	19.3
7	8.2	9.8	9.7
8	5.2	4.7	4.7
9	2.6	2.0	2.3
10	1.7	2.2	2.5
11	0.9	1.6	1.5
12	0.7	1.2	1.3
13	0.2	0.7	0.5
14	--	0.4	0.1
15	--	0.3	0.2
16	0.3	0.3	0.4
17	--	0.3	0.5
18	--	0.2	--
19	--	--	0.1
20	--	0.1	0.4
21	--	0.8	1.0
22	--	1.0	0.8
>23	--	0.4	0.6
Average complexity	5.28**	5.88	5.94

*Procedure complexity reflects the number of base units assigned to a procedure plus modifiers that take into account extremes of age (<1, >70) and poor physical status (ASA status = 3,4, or 5).

**Significantly different from mean for MDAs only ($p < .05$).

Source: CHER Anesthesia Practice Survey.

Further, although the average ASA physical status score does not vary between the CRNA-only (1.84) and anesthesiologist-only (1.89) groups, anesthesiologists and CRNAs working together had a higher risk caseload, with an average ASA score of 1.97. Additionally, CRNAs working alone saw more emergency cases (17 percent) than the other two groups (11 percent), had a larger outpatient surgical caseload (43 percent) relative to the other two groups (30-40 percent), and were involved in shorter procedures, on average, than the other two groups (90 minutes vs 96-101 minutes).

Type of Anesthesia

Another dimension of the substitutability of CRNAs for anesthesiologists is reflected in the types of anesthetic techniques performed: general anesthesia (the dominant form), regional anesthesia, and the less interventionist methods including monitored anesthesia care and intravenous sedation. According to Table 4-3, only slight differences are found among the three groups with respect to the anesthetic technique in nonobstetric cases. General anesthesia accounts for about three-fourths of the cases regardless of provider type. Anesthesiologists are slightly more likely to be involved in cases with regional anesthesia where as CRNA-only cases tended to require less intervention.

Table 4-4 reports who was the primary provider during the induction and maintenance of and emergence from anesthesia, by type of case and type of anesthesia. The designation of primary provider in the anesthesiologist/CRNA cases is heavily dependent on who reported the case. In the cases reported by CRNAs, 81 percent indicated they were the primary provider while 18 percent said

TABLE 4-3

TYPE OF ANESTHESIA PROVIDED, BY ANESTHESIA PROVIDER

Anesthesia Type	CRNA Only (n=707)	MDA & CRNA (n=1,792)	MDA Only (n=1,224)
All Cases			
General	64.9%	70.4%	72.3%
Spinal	6.1	8.0	5.2
Epidural	8.1	4.3	6.7
Nerve block	6.2	7.0	7.4
Monitored anesthesia care	10.8	7.0	5.2
Intravenous sedation only	2.8	2.1	2.0
Both general and regional	1.1	1.2	1.2
Obstetric Cases			
General	15.7	30.3	20.2
Spinal	6.6	17.4	18.0
Epidural	43.0	50.5	56.2
Nerve block	10.7	0.9	1.1
Monitored anesthesia care	22.3	0.0	2.3
Intravenous sedation only	0.8	0.0	0.0
Both general and regional	0.8	0.9	2.3
Non-Obstetric Cases			
General	75.0	73.0	76.4
Spinal	6.0	7.4	4.2
Epidural	0.9	1.3	2.8
Nerve block	5.3	7.4	7.9
Monitored anesthesia care	8.4	7.5	5.4
Intravenous sedation only	3.3	2.3	2.1
Both general and regional	1.2	1.2	1.2

Source: CHER Anesthesia Practice Study.

TABLE 4-4

PRIMARY ANESTHESIA PROVIDER, BY TYPE OF CASE AND ANESTHESIA

		MDA & CRNA			
	CRNA Only	Weighted Average	Reported by CRNA	Reported by MDA	MDA Only
All Cases					
CRNA	96.0%	60.1%	81.1%	36.3%	--
MDA	--	38.5	17.9	61.9	99.6%
Surgeon	4.0	1.1	0.4	1.8	0.4
Shared	--	0.3	0.6	--	--
Obstetric Cases					
CRNA	87.6	34.3	48.6	7.9	--
MDA	--	65.7	51.4	92.1	100.0
Surgeon	12.4	--	--	--	--
Shared	--	--	--	--	--
Non-Obstetric Cases					
CRNA	97.8	61.8	83.7	37.6	--
MDA	--	36.8	15.2	60.5	99.6
Surgeon	2.2	1.1	0.5	1.9	0.4
Shared	--	0.4	0.7	--	--
General Anesthesia					
CRNA	99.6	67.3	88.5	41.5	--
MDA	--	32.3	10.8	58.6	100.0
Surgeon	0.4	--	--	--	--
Shared	--	0.4	0.7	--	--
Regional Anesthesia*					
CRNA	90.3	28.2	47.9	10.1	--
MDA	--	68.3	50.9	84.4	97.9
Surgeon	9.7	3.5	1.2	5.6	2.1
Shared	--	--	--	--	--

*Includes spinal, epidural, and nerve block anesthesia.

Source: CHER Anesthesia Practice Survey.

the anesthesiologist was the primary provider. Conversely, anesthesiologists reported they were the primary provider in 62 percent of cases and a CRNA in only 36 percent of cases. Despite the systematic bias between the anesthesiologist and CRNA reports, the relative frequencies across the two types of anesthesias (general and regional) and the types of cases (obstetric and nonobstetric) are consistent. When the responses are aggregated, it was found that CRNAs are primary provider in 3-in-5 cases and anesthesiologists in about 2-in-5.

Nature of Physician Supervision

In cases involving both anesthesiologists and CRNAs, reports on the anesthesiologist's presence in the operating room vary according to whether the anesthesiologist or CRNA responded to the survey. As shown in Table 4-5, 63 percent of the CRNAs reported that the anesthesiologist was present during the entire induction, while 92 percent of the anesthesiologists reported they were present for all of the induction (the weighted average is 76 percent). At the other extreme, 19 percent of CRNAs and 4 percent of anesthesiologists reported they were present for none of the induction.

An anesthesiologist is less likely to be involved during the entire emergence, although anesthesiologists continue to report substantially more involvement than CRNAs report. Nearly half of the anesthesiologists said they were present during the entire emergence versus one-fifth of the CRNAs. Two-thirds of the CRNAs reported the anesthesiologist was present for none of the emergence while only

TABLE 4-5

PRESENCE OF ANESTHESIOLOGIST DURING INDUCTION AND EMERGENCE IN CASES WITH BOTH MDA & CRNA INVOLVEMENT

	MDA Presence During Induction			MDA Presence During Emergence			MDA Presence During Entire Induction And Emergence
	All	Some	None	All	Some	None	
All Cases							
Reported by CRNA	62.9%	18.5%	18.6%	18.6%	14.7%	66.7%	24.7%
Reported by MDA	91.5	4.4	4.1	48.0	33.3	18.7	50.6
Weighted Average	76.4	11.9	11.8	32.3	23.4	44.3	39.2
Obstetric Cases							
Reported by CRNA	78.6	7.1	14.3	22.5	21.1	56.3	25.0
Reported by MDA	94.7	2.6	2.6	40.5	29.7	29.7	42.9
Weighted Average	84.3	5.6	2.6	28.7	24.1	47.2	31.9
Non-Obstetric Cases							
Reported by CRNA	61.7	19.4	18.9	18.2	14.2	67.6	24.7
Reported by MDA	91.4	4.5	4.1	48.4	33.4	18.2	51.0
Weighted Average	75.9	12.3	11.8	32.5	23.3	44.1	39.7

*If the MDA was designated as the primary provider during induction, we have assumed that the MDA was present for all of induction.

Source: 1986 Anesthesia Practice Survey.

one-fifth of the anesthesiologists indicated they were absent during emergence (a weighted average of 32 percent).

Table 4-6 presents the survey results of reported anesthesiologist presence during induction and emergence by ASA physical States codes. The discrepancy between anesthesiologist and CRNA reports persists in this analysis, although in both cases there was slightly more anesthesiologist involvement with sicker than with healthier patients.

Since State licensure statutes require that CRNAs be supervised by a physician, the Anesthesia Practice Survey asked CRNAs who reported no anesthesiologist involvement in their cases about the surgeon's involvement. Table 4-7 shows the CRNAs reports of surgeon's involvement in nonobstetric cases categorized by the patients' ASA physical status. The surgeon is more likely to participate in the assessment of pre-operative medical status for sicker patients than healthier patients but less likely to participate in developing the anesthesia plan for both the sickest and the healthiest patients than for the ASA-2 or ASA-3 cases. Surgeons were also most likely to participate in induction for ASA-2 and ASA-3 patients.

TABLE 4-6

PRESENCE OF ANESTHESIOLOGIST DURING INDUCTION AND EMERGENCE IN CASES WITH BOTH MDA AND CRNA INVOLVEMENT, BY ASA PHYSICAL STATUS

	MDA Presence During Induction			MDA Presence During Emergence		
	All	Some	None	All	Some	None
Weighted Average						
ASA 1	78.8	10.4	10.8	32.1	22.9	45.0
ASA 2	73.8	11.2	15.0	29.7	23.4	46.9
ASA 3	74.0	15.4	10.6	34.1	23.0	43.0
ASA 4 or 5	86.0	11.0	3.0	41.1	28.4	30.5
Reported by CRNA						
ASA 1	65.4	16.1	18.5	16.1	14.9	69.0
ASA 2	60.5	17.3	22.2	17.6	12.1	70.3
ASA 3	59.1	24.2	16.7	22.8	15.2	62.1
ASA 4 or 5	77.2	17.5	5.3	24.1	27.8	48.1
Reported by MDA						
ASA 1	92.9	4.3	2.8	49.4	31.5	19.2
ASA 2	90.0	3.7	6.3	44.9	37.6	17.5
ASA 3	90.0	6.0	4.0	46.4	31.4	22.2
ASA 4 or 5	97.7	2.3	--	63.4	29.3	7.3

Source: CHER Anesthesia Practice Survey.

TABLE 4-7

INVOLVEMENT OF SURGEON IN CASES WITH NO ANESTHESIOLOGIST, BY ASA PHYSICAL STATUS: NON-OBSTETRIC CASES

	ASA Physical Status			
	ASA 1 (n=194)	ASA 2 (n=189)	ASA 3 (n=90)	ASA 4 or 5 (n=29)
Percent of cases in which surgeon participated in assessment of preoperative medical status with regard to the anesthesia	25.3	29.3	44.4	42.9
Percent of cases in which surgeon participated in development of anesthesia care plan	11.9	18.0	28.9	13.8
Medical Direction During Induction				
Surgeon was primary provider	0.5	4.2	4.4	0.0
CRNA received direction from surgeon	6.7	8.5	23.3	10.3
CRNA received no direction	92.8	87.3	72.2	89.7

Source: CHER Anesthesia Practice Survey.

Summary

This chapter has presented the use of composite measures to compare the relative involvement of CRNAs and anesthesiologists in selected surgeries according to case mix complexity across surgical procedures and case mix severity within such procedures.

Using the results of the 1986 Anesthesia Practice Survey, all three provider types were found to be about equally involved in the least complex cases but among the most complex cases, no anesthesias were performed by CRNAs working alone. Across all cases, CRNAs working alone performed significantly less complex procedures than did CRNA/anesthesiologist teams or anesthesiologists working alone. In regard to within-procedures severity variations, surgeries performed on younger patients (less than 1 year of age) were more likely to involve anesthesiologists.

Variation in the type of anesthetic technique performed followed a weakly similar pattern across providers, with CRNA-only cases somewhat less likely to involve general anesthesia overall, and cases attended by anesthesiologists slightly more likely to use regional anesthesia techniques.

Reports of who was the primary anesthesia provider depended largely on who reported the case, as did reports of the amount and nature of operating room supervision in cases involving anesthesiologist-CRNA teams. Both groups, however, reported slightly more anesthesiologist involvement with sicker than with

healthier patients. When no anesthesiologist was involved, surgeon supervisors were reported to be more likely to participate in the assessment of pre-operative medical status of the sickest patients, but in developing anesthesia plans or participating in induction, they were more likely to be involved in the mid-range ASA-2 and ASA-3 cases.

CHAPTER 5

QUALITY OF ANESTHESIA CARE: A LITERATURE REVIEW

The annual incidence of anesthetic-related mortality is roughly 1-in-10,000 cases (Davies and Strunin, 1984) or 2,000 deaths per year (ECRI, 1985). Anesthetic complications occur in approximately 180 of every 1,000 cases (1/6), while major postoperative complications occur in 5 of every 1,000 cases (Cohen et al., 1986). Tabatabai (1981) identifies many factors that may contribute to adverse outcome: the action of the anesthetic agent, particularly its effect on the respiratory and cardiovascular systems; presence of secondary medical diagnoses, especially cardiac problems; circumstances and techniques of anesthesia management; dependability of equipment; physiology of the patient; proficiency of the surgeon; unanticipated reactions to drugs; and education and experience of the anesthetist.

In its literature review, CHER reviewed three studies that explicitly examined anesthesia outcomes by provider type. The following are summaries of those studies.

Forrest: "Outcome—The Effect of the Provider"

Forrest (1980) reports on the findings of the Stanford Center for Health Care Research (SCHSR) study of surgical outcomes in 17 hospitals across the nation. The motivation was to investigate whether variations in surgical outcomes might be explained by mix of anesthesia providers. Two groups of hospitals were compared: those in which anesthesiologists primarily provided anesthesia services

(9 hospitals, 5,159 patients) and those utilizing primarily nurse anesthetists (7 hospitals, 3,405 patients). The patient data were collected prospectively from May 1973 to February 1974. Each observed outcome was compared to the predicted outcome and then aggregated to the hospital level, yielding a ratio called the indirect standardized mortality ratio.

While minor deviations from predicted outcomes by hospital-types were noted, no relationships held even when controlling for hospital and community characteristics. The main criticism of the study is the lack of differentiation within hospitals as to who actually performed the anesthesia.

Gibert: "Outcome—Experience and Training of the Anesthetist"

In Gilbert's study (1980), the type of anesthetist is identified at the patient level. However, study is limited to a single major teaching hospital (Massachusetts General Hosptial). Using regression techniques and the analysis of residuals, Gibert reported on the variations in actual versus expected outcomes according to a variety of patient characteristics as well as the anesthetist's training and experience. The results revealed that patients of senior physicians had better outcomes than expected while all other groups were neither better nor worse than expected. The interpretation of these findings is unclear.

Bechtoldt: "Committee on Anesthesia Study Anesthetic-Related Deaths: 1969-1976"

Bechtoldt (1981) summarizes the results of an 8 year retrospective study of anesthetic-related deaths in North Carolina from 1969 to 1976. About 900 perioperative deaths occurring during the 8 year period were reviewed out of which 90 were found to "have a significiant relationship to the anesthetic." CRNAs working alone were, by far, the dominant providers of anesthesia in North Carolina during the study period. The number of deaths attributed to them was proportional to the number of anesthetics they administered. However, a weakness of this study is its failure to take into account case mix differences that might influence mortality rates

These three studies, taken together, do not appear to provide significant information on the extent to which nurse anesthetists and anesthesiologists might provide care of differing quality. First there is concern over the generalizability of the findings. Also, differences in the designation of the type of anesthesia provider may lead to measurement error and limit the comparability of findings across the studies. A further limitation concerns the subjectivity of the measurement of the outcomes itself. Finally, the studies fail to adequately adjust for systematic differences in pre-operative health status.

Anesthesia Patient Risk Factors

The formation of Anesthesia Study Commissions "to learn, why when and how anesthesia fatalities occurred" dates back to 1934 (Bendixen, 1978). By the late

1950s, committees were functioning in 18 States across the nation. A classic article on "The Risk of Anesthesia," by Goldstein and Keats (1970), suggests that the wide variation may result, in part, from differences in the definition of anesthetic death. First, designation of the role of anesthesia is subjective and generally based on retrospective judgment, hindsight, bias, and incomplete information. Second, the role of drugs is difficult to discern. Third, a standard time period for considering the role of anesthesia has not been adopted. And, fourth, the necessity for a sufficient number of observations creates difficulty, given the rarity of the event.

Despite these definitional concerns surrounding an "anesthetic death," the literature has been quite consistent in identifying risk factors for anesthesia mortality. Patient age and sex have often been noted as risk factors with anesthesia mortality higher at both extremes of age, and men have higher death rates than women. Patient physical status, as defined by the ASA Physical Status Scale has been viewed by some as a strong predictor of anesthesia mortality, but it has been demonstrated that while pre-operative physical status is strongly related to the incidence of surgical mortality, it is a poor predictor of anesthesia risk.

In addition to the documented risk factors, a number of "unquantified risk factors" have been omitted from previous studies. These factors relating to the personnel providing the therapy and their environment included: selection of patients for surgery, technical skills of personnel, human errors, adequacy of facilities to diagnose and treat complications, and skills of ancillary personnel. The landmark study by Beecher and Todd (1954), for example, found that the most experienced anesthetists had the highest mortality rates, but this was believed to result from unmeasured case mix differences between residents and teaching faculty.

Sources of "Human Error"

Researchers at Harvard Medical School have attempted to understand the "human factors" contributing to anesthesia mishaps. Their method, called a Critical Incident study, involves retrospective or ongoing reporting of anesthesia mishaps by anesthesiologists, residents, and nurse anesthetists in four Boston-area hospitals.

The majority of critical incidents (70 percent) were the result of human error; 13 percent were due to breathing-circuit disconnections; and 11 percent resulted from equipment failure. The most frequent activities resulting in human error were drug administration, anesthesia machine use, and airway management. In addition, the study described "associated factors" that "conceivably could have contributed to the occurrence of an error or to a failure to promptly detect an error." The most frequent associated factor was inadequate total experience, with a compounding factor being poor supervision.

External controls--such as licensure, certification, and accreditation--are important mechanisms for controlling the quality of health care providers in the United States. The following sections describe licensure, certification, and accreditation processes, specifically as they apply to anesthesia care providers.

State Regulation of Anesthesia Care Providers

In all States, physicians are licensed for the practice of medicine generally and not to practice in a particular specialty (e.g., anesthesiology). To be licensed as a

medical doctor (M.D.), or as a doctor of osteopathic medicine (D.O.), an individual must graduate from an approved medical school or from an approved college of osteopathic medicine, respectively. In addition, about three-fourths of the States require 1 year of postgraduate medical education, and most States require successful completion of written and/or oral examinations.

Licensure requirements for nurse anesthetists exhibit more variation across States than those for physicians. At a minimum, all States require licensure as a registered nurse. In some States (Exhibit 5-1), no additional licensure requirements exist, because nurse anesthesia practice is not specifically recognized. The generic practice of professional nursing is inferred to included nurse anesthesia. Other States indirectly authorize the practice of nurse anesthesia, either through the Hospital Code or Medical Practice Act. Still other States specifically recognize the practice of nurse anethesia in their Nurse Practice Acts or Board of Nursing Rules and Regulations. Special recognition is usually accompanied by explicit certification requirements as well as delineation of the scope of nurse anesthesia practice.

The issue of physician supervision or collaboration is emphasized in States having "direct recognition" statutes and, in other cases, legislation explicitly recognizing the practice of nurse anesthesia is designed to extend direct third-party reimbursement to qualified providers.

EXHIBIT 5-1

RECOGNITION AND LICENSURE OF NURSE ANESTHESIA PRACTICE, BY STATE

Generic Definition of Practice of Nursing (R.N. license required only)

Colorado
Connecticut
District of Columbia
Illinois
Kansas
North Carolina
North Dakota
Oregon
Rhode Island
Texas
Vermont
Wisconsin
Wyoming

Indirect Recognition of Nurse Anesthesia Practice (special licensure/ certification requirements apply)

Indiana
Missouri
New York
Ohio

Direct Recognition of Nurse Anesthesia Practice (special licensure/ certification requirements apply)

Alabama
Alaska
Arizona
Arkansas
California
Delaware
Florida
Georgia
Hawaii
Idaho
Iowa
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Minnesota
Mississippi
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
Oklahoma
Pennsylvania
South Carolina
South Dakota
Tennessee
Utah
Virginia
Washington
West Virginia

Source: Adapted from materials prepared by the American Association of Nurse Anesthetists.

Certification of Anesthesia Care Providers

Unlike the physician licensure process, certification in anesthesiology is voluntary and is supervised by independent, nongovernmental specialty boards. To be eligible for board certification in anesthesiology, a physician must hold a license to practice medicine, complete an accepted 4 year postgraduate program in anesthesiology, obtain a Certificate of Clincial Competence after 24 months of clinical anesthesia residency training, and pass written and oral examinations required by the American Board of Anesthesiology. In 1984, 43.6 percent of all anesthesiologists were board-certified in anesthesiology (AMA, 1985). At present, the specialty boards do not have a recertification process. Rather, assurances of continued competence are part of the State relicensure process.

In contrast to physician licensure, the authority to practice nurse anesthesia often requires certification by the AANA's Council on Certification of Nurse Anesthetists, particularly in the "direct recognition" States. To become a CRNA, an individual must graduate from an approved nursing school, be actively licensed as a registered nurse, graduate from an approved nurse anesthesia program, accredited by the Council on Accreditation of Nurse Anesthesia Educational Programs/Schools, and complete all examinations required by the Council on Certification of Nurse Anesthetists. It is estimated that 95 percent of the registered nurses who administer anesthesia in the U.S. are certified, based on data from States that have legalized the certification process. Recertification, required every 2 years, involves documentation of initial certification, possession of a State license, completion of 40 hours of continuing education in the preceding 2 years; active, full- or part-time practice within the previous 2 years; and certification by the applicant of fitness to practice anesthesia.

Accreditation of Hospitals

The JCAH surveys hospitals to assess their compliance with numerous standards covering all facets of a hospital's operation. As a March 1985, 5,156 of the 6,872 hospitals in the United States (75 percent) had been accredited by the JCAH (AHA, 1985).

The JCAH standards are probably the most widely applied standards for anesthesia care. Within each standard are numerous "required characteristics" which a complying hospital must meet. This section discusses those aspects of the standards having the greatest applicability for determining the parameters within which anesthesia services may be delegated to nonphysician providers (principally CRNAs).

Standard I: Anesthesia care is available in a hospital that provides surgical or obstetrical services. The "required characteristics" associated with this standard relate primarily to the organizational attributes of anesthesia services in a hospital and would limit overall administrative responsibility for anesthesia services to a member of the medical staff, although not necessarily an anesthesiologist.

Standard II: Staffing for the delivery of anesthesia care is related to the scope and complexity of service offered. Based on this standard, anesthesia care may be provided by physician and nonphysician anesthetists. However, the standard requires that: 1) nurse anesthetists be able to provide general anesthesia, 2) nurse anesthetists be under the overall direction of the full-time anesthesiologist who heads the anesthesia department/service or where such an arrangement does not

exist, the surgeon or obstetrician who is responsible for the patient's care, and 3) responsibilities of nurse anesthetists and attending physicians be defined in a policy statement or job description.

This standard allows the provision of general anesthesia by nurse anesthetists, but leaves to individual hospital discretion and documentation other aspects of nurse anesthetist practice. In particular, the standard is silent on the administration of regional anesthesia or the use of invasive monitoring by nurse anesthetists except that such functions must be delineated in a policy statement or individual job description.

Standard III: Precautions are taken to assure the safe administration of anesthetic agents. This standard pertains primarily to conditions required for the safe administration of flammable anesthetic agents and for preventing electrical hazards.

Standards IV: There are written policies that relate to the delivery of anesthesia care. This standard is specific in the recommendation that a physician conduct the postanesthesia visit and record any complications in the patient's chart. Similarly, the pre-anesthetic evaluation is considered to be a physician responsibility. The other activities are presumed to be the responsibility of the anesthetist, whether a physician or nonphysician. The application of these written policies may be subject to the interpretation of the on-site survey team. For example, in some hospitals without a full-time anesthesiologist, nurse anesthetists perform the pre-and post-anesthesia evaluations and the surgeon reviews the chart.

Standard V: As part of the hospital's quality assurance program, the quality and appropriateness of patient care provided by the anesthesia department/service are monitored and evaluated and identified problems are resolved.

Guidelines for Anesthesia Care

The notion of written policies for anesthesia care, as stated in JCAH Standard IV, and the requirement of "direction" in Standard II, has been addressed by ASA and AANA policy statements. While the policy statements do not have the force of "standards," in some cases State legislatures have included sections of the guidelines in licensure laws for nurse anesthetists. Additionally, many facilities utilize the guidelines in developing "job descriptions" for nurse anesthetists. Nonetheless, these statements may not be objective measures of what constitutes "appropriate" anesthesia practice because they emanate from membership organizations charged with furthering the interests of their respective constituents.

The AANA Guidelines for the Practice of Nurse Anesthetists define the permissible scope of nurse anesthesia practice (AANA, 1983). The Guidelines complement the Association's Standards for Nurse Anesthesia Practice, developed as a means to evaluate the quality of care rendered by nurse anesthetists (AANA, 1983). Neither the guidelines nor the standards were intended as requirements, because it is recognized that practice patterns and legal mandates vary across localities.

The ASA House of Delegates has adopted two policy statements delineating the composition of the Anesthesia Care Team and the delegation of tasks to

nonphysicians. Both statements acknowledge the role of nonphysician personnel in the delivery of anesthesia care, particularly in areas of manpower shortages. The guidelines stipulate, however, that delegation should be based on the qualification and competence of the individual, although such tasks would be performed under the personal direction of an anesthesiologist or other qualified physician. Consistent with the JCAH standards, the ASA policy statements call for written policies regarding delegation and supervision of anesthesia care provided by nonphysicians, with approval by hospital medical staff. They also specify the functions to be carried out by nonphysician personnel, including the induction of anesthesia under an anesthesiologist's direction, maintenance of anesthesia at prescribed levels, monitoring and support of life functions, and recognizing and reporting to the anesthesiologist abnormal signs during anesthesia.

An ongoing controversy within the professions concerns the administration of regional anesthesia by nonphysician personnel. The policy statements of the ASA and AANA reinforce this controversy. The ASA House of Delegates adopted a policy statement in October 1983 that concludes "regional anesthesia should be performed only by an anesthesiologist or other physician trained in the administration of anesthesia," while the Council on Nurse Anesthesia Practice approved a policy statement in April 1986 stating "the AANA takes the position that where CRNAs have acquired the necessary education and demonstrated competency to provide regional anesthesia care, the CRNA shall be allowed to administer regional anesthesia care."

Quality Assurance in Anesthesia

The most common technique for evaluating the process of anesthesia care is through a quality assurance program. Quality assurance (in its generic form) is a requirement for accreditation by the JCAH; a condition of participation in the Medicare program; and an integral part of a hospital's risk management effort. A quality assurance program tends to be multifaceted, involving a combination of quality assurance program tends to be multifaceted, involving a combination of strategies for evaluating the quality of patient care.

In response to the JCAH requirement for monitoring and evaluating the quality and appropriateness of anesthesia services, the ASA (1986) prepared a manual on Peer Review in Anesthesiology. The ASA suggests four techniques for quality evaluation: morbidity and mortality conferences; unusual or difficult case conferences; screening for postanesthesia complications; and periodic review of anesthetic management through observation or chart audit. Departmental conferences concerning morbidity, mortality, or difficult or unusual cases should be accompanied by an ongoing monitoring program such as complications screening or process review. A variety of quality assurance mechanisms have to fit the needs of various types of hospitals--large and small, teaching and nonteaching.

Summary

This chapter set out to answer the question "Does the quality of anesthesia care vary by the type of provider?" Three studies have explicitly addressed this question and none detected significant differences in anesthesia outcomes among nurse anesthetists versus anesthesiologists.

One possible conclusion is that the three studies, taken together, indicate that the two groups provide care of equal quality. Thus, despite the vast differences in training, on-the-job experience and inservice education would compensate for a nurse anesthetist's fewer years of training.

An alternative conclusion, at the other end of the continuum, is that the two groups do not provide care of equal quality but methodological flaws in the three studies mask the differences.

A third, alternative conclusion might be drawn from these studies and other supporting evidence that, though the two groups may be unequal in training, in the tasks they perform, or the severity of their patients, their outcomes may be equivalent as a result of insitutional mechanisms that promote the quality of anesthesia care provided by both nurse anesthetists and anesthesiologists.

These extensive mechanisms include: 1) licensure and certification of providers which serve as "barriers to entry," 2) JCAH standards for hospital-based anesthesia services, imposing requirements for quality assurance activities as well as supervision of nurse anesthetists, 3) the ASA, AANA, and many State licensure laws requiring or recommending that facilities develop written guidelines delineating the scope of a nurse anesthetist's practice and the nature of supervision, 4) careful data collection and analysis activities, and 5) the triaging of patients according to an anesthetist's competence.

This third conclusion would appear to the most logical explanation for the similarity of anesthesia outcomes among anesthesiologists and CRNAs. No one

would argue that the training of nurse anesthetists and anesthesiologists is comparable. Since outcomes have not been shown to differ, this may be direct result of institutional mechanisms designed to maintain the quality of all anesthesia care.

CHAPTER 6

LIABILITY ISSUES IN ANESTHESIA

There are approximately 2,000 anesthetic-related mortalities every year, occurring in about 1 in 10,000 anesthesias. As a result, there have been a growing number of malpractice claims from anesthesia incidents. Although anesthesia mishaps are rare, they are costly to malpractice insurors. The Harvard Risk Management Foundation (1985) reported that anesthesia-related claims accounted for only 3-4 percent of all claims but almost 10 percent of settlements. Analyzing the outcome of anesthesia-related malpractice claims provides another approach to comparing the quality of care provided by CRNAs versus anesthesiologists.

To effectively relate incidence and outcome of anesthesia-related malpractice claims to quality of care, it is necessary to understand the criteria for establishing liability in the event of a mishap. This section focuses as primarily on the issue of a surgeon's liability when working with a CRNAs versus an anesthesiologists.

Analysis of Malpractice Liability Issues by the AANA and ASA

Due to the vast implications of the liability issue, the AANA and the ASA have devoted considerable resources to analyzing such trends. However, the interpretation of court decisions by counsel to the ASA and the AANA has yielded a difference of opinion.

The AANA opinion is reflected in the concluding sentence of an article by AANA counsel Gene Blumenreich (1985): "...there is simply no rational basis for a surgeon to choose between a nurse anesthetist or an anesthesiologist based on the differences in State licensing laws." Blumenreich reasons that all members of the operating room team are likely to be named in a suit and the courts will decide who, if anybody, was actually at fault. This poses an apparent contradiction with the belief of the counsel to the ASA, Michael Scott, (1986) "...that there is a greater tendency on the part of the courts...to hold surgeons liable for the acts of nurse anesthetists than for the acts of anesthesiologists." Scott relates this to the statutory obligation on the part of the surgeon to supervise a nurse anesthetist in his or her duties.

Further investigation showed, and Blumenreich and Scott agree, that liability depends on the facts of the case. The courts have not based a liability finding solely on a surgeon's legal obligation to supervise a nurse anesthetist. Instead, in cases involving anesthesiologists and nurse anesthetists alike, courts look closely at the events surrounding a mishap to determine who is liable. Thus, both legal doctrine and case history do not indicate a tendency on the part of the courts to hold surgeons liable more often when they work with nurse anesthetists than with anesthesiologists.

Malpractice Premiums

Variations in the malpractice insurance premiums of surgeons that work with nurse anesthetists versus those that work with anesthesiologists serve as another potential proxy for quality differences. If working with a nurse anesthetist

increases the frequency of an anesthesia mishap, such physicians would be expected face to higher insurance premiums, assuming that premiums reflect the likelihood of an adverse malpractice settlement (as well as the level of compensation). Individuals in several regions of the country were interviewed to determine whether malpractice premium surcharges are levied on surgeons for working with nurse anesthetists.

Representatives of the St. Paul Insurance Company, the main carrier of liability insurance for CRNAs and a large carrier for surgeons and anesthesiologists, revealed that their company imposes a surcharge on surgeons and anesthesiologists who employ CRNAs (both as independent practitioners and as groups), amounting to about 3 percent of their premiums for each CRNA they employ. This is in response to the court's use of the borrowed servant doctrine in determining liability for anesthesia mishaps. Therefore, the surcharge to physician groups employing nurse anesthetists apparently is not due to any unusual risk incurred by employing a nurse anesthetist. Surgeons who employ anesthesiologists are not surcharged because the anesthesiologist carries substantial liability coverage of his/her own.

Similar experiences were reported in four States where physician-owned insurance companies dominate: Texas, Oklahoma, Connecticut, and Mississippi. An important court case in Oklahoma sheds light on the legal distinction between employing versus simply working with CRNAs. In 1983, Physicians' Liability Insurance Company of Oklahoma attempted unsuccessfully to implement a surcharge for all physicians simply working with (and not employing) nurse anesthetists. The State insurance commissioner refused to grant the surcharge due to the carrier's inability to provide actuarial justification for the surcharge.

In general, surcharges have been imposed on physicians employing CRNAs, but not on those supervising CRNAs employed by others.* This is due to the nature of vicarious liability. Employers may be held liable for the negligence of employees, whereas surgeons or anesthesiologists supervising CRNAs not in their employ are liable only for their own acts of negligence (including failure to properly supervise).

Summary

This chapter has reviewed the potential for using malpractice claims, settlements, and insurance premiums as indicators of quality of care differences between nurse anesthetists and anesthesiologists. The doctrine of vicarious liability may be used in malpractice cases to place the financial burden of liability on the principal, rather than the agent. This phenomenon is called the deep pocket theory. The plaintiff is likely to seek compensation from the party with the largest insurance coverage, and this is most often the principal. Because of the deep pocket phenomenon, it is difficult from a research standpoint to link liability decisions to quality of care.

In reviewing malpractice insurance premiums, it was concluded that although surgeons may be surcharged for employing nurse anesthetists, this is due to the nature of vicarious liability and may not reflect an increased likelihood of a mishap. With little exception there is a noticeable absence of surcharges for working with nurse anesthetists.

*The exception to this is found in the Dallas/Fort Worth area where surgeons and anesthesiologists are surcharged for working with CRNAs. However, the legality of this surcharge has yet to be tested due to a backlog at the insurance commissioner's level.

The evidence thus accumulated suggests that information on malpractice decisions is not an effective proxy for the quality of anesthesia care delivered by nurse anesthetists versus anesthesiologists, primarily because of the issue of vicarious liability. Similarly, surcharges on surgeons' malpractice insurance premiums may reflect vicarious liability rather than actual quality differences. However, to the extent that it has been determined that surgeons simply working with but not employing nurse anesthetists have not been subjected to surcharges, there is evidence that insurers do not recognize surgeons to be at higher risk when working with a nurse anesthetist than with an anesthesiologist.

CHAPTER 7

CRNA PAYMENT OPTIONS

Medicare payment options for CRNA services entail major implications not only for the security of CRNA employment but also for the total amount of Medicare anesthesia expenditures. In describing the payment options for CRNA services, it is necessary to consider anesthesiologist reimbursement as well. This is because the two anesthetists can be substitutes for each other across a wide range of surgeries. As such, any change in reimbursement policy that would materially affect the use of one provider will have similar effects in the opposite direction on the other anesthetist. Hence, one cannot rigorously evaluate the policy implications of a change in CRNA reimbursement without also considering how anesthesiologists will be paid.

It is also necessary to consider the current manpower trends in the absence of any policy change. The supply for anesthesiologists has been growing more rapidly than CRNAs for many years. Unless the relative demand for the two inputs changes significantly through a change in reimbursement policy, more physicians than CRNAs could be providing anesthesia care to Medicare patients 10-15 years from now. In other words, a "neutral" reimbursement policy regarding CRNAs and anesthesiologists will not assure even a status quo mix of providers in the future, which has obvious cost implications for the Medicare program.

The four generic payment options under discussion include:

(1) Extending the current CRNA Part A pass-through indefinitely;

(2) Including CRNA services in the Part A hospital DRG payment;

(3) Establishing a DRG payment for all anesthesia services; and

(4) Permitting direct Part B billing for CRNA services.

While there are several variations of these generic payment options the underlying incentive structures are essentially the same.

These options are not always mutually exclusive, nor are they equally viable in the legislative sense. Direct Part B billing for CRNA services, for instance, will become law in 1989 absent an act of Congress while an anesthesia DRG would require new legislation. Nevertheless, it is instructive to discuss the pros and cons of all four options to put each in proper perspective.

Table 7-1 summarizes the predicted effects of the major payment options on seven outcome criteria. Outcomes are limited to the most immediate effects on provider input mix and costs. Subsequent effects on beneficiary quality and access may depend on these "first-order" manpower responses. Predictions are based on the strength of reimbursement incentives. Changes that might actually be observed depend on several issues aside from the financial considerations.

Option #1: CRNA Part A Pass-Through

Option 1 would continue the existing CRNA Part A pass-through. As such it is the status quo, with hospitals fully reimbursed for the costs of services provided by hospital-employed CRNAs, and any hypothesized trends reflect only the underlying

TABLE 7-1 SUMMARY OF PREDICTED EFFECTS OF ALTERNATIVE PAYMENT OPTIONS FOR CRNAs AND ANESTHESIOLOGISTS

	CRNA USE	MDA USE	CRNA HOSPITAL EMPLOYMENT	REAL ANESTHESIA COSTS PER OPERATION	AVERAGE WAGE CRNA	AVERAGE WAGE MDA
1. CRNA Part A Pass Through	-	+	o	+	o	?
2. CRNA Part A-only	--	++	--	++	-	?
3. Anesthesia DRG						
3a. Paid to Hospital	++	--	++	--	++	-
3b. Paid to Physician Group	+	-	+	-	+	-
3c. Paid to Provider (MDA or CRNA)	-	+	--	+	+	?
4. CRNA Direct Part B billing	-	+	-	+	+	o

Symbols:
- o = no change
- - = slight annual decrease
- -- = significant annual decrease
- + = slight annual increase
- ++ = significant annual increase
- ? = uncertain effect

trends in the relative demand and supply of the two providers. No effect on the demand for CRNAs, together with positive growth in the supply of anesthesiologists, suggest the slow replacement (or increased supervision) of CRNAs by anesthesiologists. This trend is accelerated somewhat by increased competition in the hospital industry. As hospitals compete for patients, some administrators see anesthesiologists as an upgrade in their surgical skill mix, reinforcing the secular trend away from CRNAs in a system where both types of anesthetists are considered "free" inputs to the principal decisionmakers; namely, hospital administrators, surgeons, and anesthesiologists. The pass-through would not discourage or encourage CRNA hospital employment although fewer overall might be working in some institutions if they are slowly replaced by anesthesiologists.

The real cost per operation will slowly rise over time either because of a substitution of a more expensive for a less expensive provider or the additional supervisory cost added to the existing CRNA costs. This should translate into greater Medicare outlays on anesthesia services as more and more anesthesiologists submit bills for surgery, even if the CRNA remains the primary provider.

Option #2: CRNA Services in Part A Hospital DRG Payment

Under this option, all services provided by hospital-employed CRNAs would be considered a Part A hospital cost like other patient services in the DRG rates. An actuarial estimate of CRNA salaries now being paid for as a hospital pass-through cost would be added to the existing surgical DRGs and a single payment made to the hospital.

Under this option, hospital administrators have a strong financial incentive to substitute "free" anesthesiologists for CRNAs. This is, in fact, what was done under the first year of PPS, and the result was predictable. According to anecdotal information, many hospitals began to let their CRNAs go in order to reduce costs under the DRG rate. Either the CRNAs would have to be re-employed by anesthesiologists or the anesthesiologists would have to replace CRNAs in the operating room.

Whether anesthesiologists would re-employ all of the dismissed CRNAs is a complicated issue, but it can be theoretically shown that the total re-employment of CRNAs by physicians would not have exactly offset their dismissals from hospitals. First of all, some hospitals previously using only CRNAs would recruit an anesthesiologist to replace them. Second, in hospitals already using a combination of the two, anesthesiologists would be required to hire CRNAs, which would imply an effective rise in the cost to the anesthesiologists. This should result in some substitution of anesthesiologists' time for CRNAs, if not in every instance, at least across anesthesiologists as a whole.

How adverse this option would be to CRNA use in surgery is impossible to determine absolutely, but relative to other options it should be considered a major change in favor of anesthesiologists versus CRNAs. Effects on total anesthesia costs are obvious. Costs would rise as more expensive physician time is substituted for CRNA time. This would add to the underlying increase in anesthesia costs per operation and be translated into greater Medicare outlays.

Option #3: Anesthesia DRG

A significant departure from the current practice of splitting anesthesia payments between Parts A and B and between CRNAs and anesthesiologists would be an anesthesia DRG that bundles the services into a single rate or a rate to be included in a radiology, anesthesia, and pathology (RAP) DRG. No unique approach to bundling exists, however, resulting in several suboptions that can be characterized along two dimensions: (1) type of anesthetist covered; and (2) who is paid the single fee.

Theoretically, the anesthesia DRG payment could be limited to anesthesiologists' services with CRNA services covered separately as a hospital pass-through, as part of the hospital DRG payment, or on a direct-billing, fee-for-service basis. However, this would require identification of the costs of CRNAs employed by anesthesiologists, an impossible task given available data. In addition, separation of payments for the two anesthesia providers would forego an opportunity to encourage the most efficient use of anesthesia providers. For those reasons, an anesthesia DRG or the anesthesia component of a RAP DRG should include both anesthesiologists' and CRNAs' services.

A complete anesthesia DRG would bundle the services of the two providers together into a single rate by surgical DRG. If anesthesia was then defined as a hospital service, payment would be folded into the existing DRG-specific hospital rate and the hospital administration would be responsible for paying both providers. The anesthesia portion of the hospital payment could be considered either a Part A or a Part B service. Paying the anesthesia or RAP DRG to a physician group such

as a RAP organization in the institution would make it a Part B service. It is also possible to pay the single anesthesia payment specifically to an anesthesiologist rather than a physician group. Finally, it would be administratively possible to even pay the global anesthesia payment to the CRNA under Part B.

Paying the Hospital

Calculating an anesthesia DRG requires that Part A and Part B bills be merged and an average expenditure on anesthesia determined by DRG. Presumably it would be nearly zero on the nonsurgical DRG, except for some minor consultation and other charges for nonsurgical services. If this global payment were folded into the hospital DRG payment, no Part B billings would be allowed. This would put the hospital at financial risk for all anesthesia care, encouraging it to choose the mix of CRNAs and anesthesiologists that minimized costs per operation. This option should enhance CRNAs' ability to compete with anesthesiologists. Real resource costs per operation should be significantly reduced, which could eventually produce major savings in Medicare outlays. Anesthesia DRG payment rates could be reduced over time as the expected substitution occurs.

Hospitals using only CRNAs now would not be immediately affected, but would be less inclined to replace their CRNAs with anesthesiologists. Where both work jointly, hospitals could be expected to limit physicians to supervision and more difficult operations, resulting in less total hours and payments to anesthesiologists and more activity for CRNAs. Hospitals currently using only anesthesiologists would be most affected. Faced with a fixed rate per operation, they may first

negotiate with their anesthesiologists to continue their surgical support at a reduced rate. Hospitals could also increase hiring of CRNAs, bidding them away from other institutions, and raising their real wages. Anesthesiologists would then assume more of a supervisory role.

Paying a Physician Group

Paying the same global anesthesia rate to a group of physicians such as the hospitals' anesthesia staff or a consortium of RAPs could have the same general effect on provider mix and Medicare payments as paying the hospital, but the outcome for CRNA usage is far less certain. While the physician group would appear to have an obvious interest in minimizing costs by achieving the most economical mix of anesthesia inputs, the physicians themselves, as opposed to hospital administrators, would be making the cost allocations. Payment directed to a physician group would probably not stimulate as much use of CRNAs as would payment to a hospital, for both financial and philosophical considerations.

Paying the Provider

Paying the single anesthesia payment to the anesthesiologist (or the CRNA when direct billing begins in 1989) would be little different from simply continuing to pass through CRNA costs in Part A. A budget neutral anesthesia rate could be somewhat below what anesthesiologists are used to receiving from Medicare, but it seems unlikely that they would be discouraged from treating Medicare patients given increased competition and their lack of an independent practice. The extent to which anesthesiologists would choose to hire more CRNAs to increase their

productivity may depend upon the abundance of anesthesiologists in a given area combined with their personal preferences. Nothing prevents them from doing so now, yet many work alone. This is a crucial difference from paying the hospital, which has a less personal stake in preserving physician autonomy.

If Medicare paid the anesthesia DRG rate to the provider, CRNA use would probably continue to decline slightly each year--at least relative to anesthesiologists. If payment rates were adjusted to reflect the changing provider mix, Medicare program outlays could increase.

Option #4: Direct CRNA Billing

The fourth option is the extension of direct Part B billing to CRNAs, as provided for in OBRA of 1986. The CRNA Part A pass-through would also be eliminated. Both Options 1 and 2 require an employment arrangement either with hospitals or physicians. Direct CRNA billing will give CRNAs the option of being financially independent of the two employers.

The argument that extending direct billing to CRNAs increases competition, thereby reducing anesthesiologists' charges and incomes, is unfounded in the hospital setting. First and foremost, patients do not choose their anesthetists, either in terms of their quality or cost. For elective surgery, their family physician will recommend a surgeon who practices at a local hospital. A group of anesthesiologists and/or CRNAs will provide the anesthesia services for all operations at the hospital under contract. The surgeon has developed a working relationship with the anesthetists and is usually indifferent to the choice for a

given operation. Indeed, the anesthetist group and not the surgeon usually decides who will provide the anesthesia based on work schedules, availability, and type of surgery. For emergency surgery, the patient clearly has no choice whatsoever and the decision is determined solely by which hospital the patient is admitted to and the immediate availability of surgeons and anesthetists.

With separate direct Part B billing for both anesthesiologists and CRNAs, anesthesia cost would be irrelevant to both the surgeon and the hospital. Surgeons are never financially responsible for anesthesia services, nor would hospitals be responsible if CRNAs could directly bill Medicare. Again, where cost is irrelevant, surgeons and hospitals will opt for the better trained input, usually the anesthesiologist, even if this decision is uneconomical from the broader perspective of real resources used and unnecessary from a quality of care perspective.

The direct billing provision may encourage CRNA use in free-standing surgical centers where the current Medicare payment methodology is similar to the inclusion of CRNA services in the hospital Part A DRG rate. Since the costs of CRNAs employed by the surgical centers are covered in a global payment, the centers can avoid such costs by using anesthesiolgists and the CRNAs employed by them. CRNA direct billing may increase CRNA employment opportunities in these centers.

It is not clear how much freelancing would occur under this option. While it is true that practically all of CRNA services would be billed to Part B of Medicare, many CRNAs now working for hospitals may simply assign their billing rights to the

hospital and continue to work on a salaried basis. Direct billing, in theory, should also result in some CRNAs leaving physician-employer groups to work and bill independently. Nevertheless, because the effective cost of the two providers to surgeons and hospitals is little affected by direct billing, their use in surgery would probably continue to decline since their competitive position would not be significantly altered.

The option of direct billing, of course, protects CRNAs in two ways compared to Option 2 which treats them as strictly a Part A service. First, hospitals will not have as strong a financial incentive to substitute anesthesiologists in their place because CRNAs can freelance and direct bill or sign over their billing rights to the hospital to cover their salary. Second, direct billing avoids forcing CRNAs to work for anesthesiologists, thereby providing CRNAs with a sense of professional autonomy, but they will still be supervised by anesthesiologists or other physicians.

On the other hand, the extension of direct billing privileges to CRNAs will further fragment medical payments at a time when efforts are being made to consolidate reimbursement. Although payments are intended to be budget neutral, Medicare will be required to establish and administer another fee schedule coupled with an increase in claims, thereby increasing program costs. These increased program costs may be offset by the fact that beneficiaries will be liable for the 20 percent Part B coinsurance requirement for all CRNA services, including those previously covered under Part A.

Conclusion

In considering Medicare payment options for CRNAs, one must also consider the mix of anesthesia providers (CRNAs and anesthesiologists) utilized and the cost implications associated with each possibility. As discussed in this report, the number of anesthesiologists has been steadily increasing over the past two decades while the number of CRNAs appears to have leveled off in recent years. Obviously, the costs of services provided by an anesthesiologist far exceed those provided by a CRNA, and with current trends in the number of each type of provider combined with the competitive pressures on hospitals to enhance services, anesthesiologists can be expected to assume a greater and greater role in delivery anesthesia services. With the current payment policy of requiring anesthesiologists to bill Medicare Part B directly while recognizing hospital-employed CRNAs as a pass-through cost, no real financial incentives exist to mitigate the trend of steadily increasing anesthesia costs.

An obvious solution, from a financial standpoint, would be to encourage the utilization of CRNAs relative to anesthesiologists. However, it remains unclear exactly how appropriate a substitute CRNAs are for anesthesiologists. CRNAs do practice without the supervision of anesthesiologists in many hospitals, but these hospitals tend to be smaller institutions with a relatively low-intensity mix of surgical procedures. The CHER survey of 1,000 anesthesia providers across the country, while not an all-inclusive analysis of anesthesia practices, did indicate that CRNAs are involved in a wide range of surgical procedures, but also showed that anesthesiologists tend to be involved to a greater extent as the complexity of

cases increases. How much of this trend is predicated on prudent medical judgement versus the simple availability of more anesthesiologists in the institutions treating complex cases is unknown.

Available studies on the outcomes of anesthesia services provided by CRNAs versus anesthesiologists and the review of malpractice premiums for surgeons utilizing CRNAs rather than anesthesiologists failed to discern any significant quality differences between the two anesthesia providers. CRNAs appear to be successfully practicing throughout the country. However, one must also keep in mind that both governmental regulations and institutional guidelines stipulate the conditions under which CRNAs are allowed to practice. The exact degree to which these regulatory and institutional controls have contributed to the standard of quality for anesthesia services is again unknown and may vary among individual providers and hospitals.

The case study at the Kaiser System in Southern California was undertaken to determine how a prepaid medical system with a reputation for adhering to high standards of quality health care utilizes CRNAs. With anesthesia departments operating under fixed budgets for the total delivery of services, it was originally thought that the Kaiser System would have established a standard mix of anesthesia providers applicable to all of its hospitals. However, CHER found extensive heterogeneity in the staffing patterns for anesthesia services across the nine hospitals. One hospital had a staffing ratio of one anesthesiologist to one CRNA; two hospitals had one anesthesiologist for every two CRNAs; four hospitals had one anesthesiologist for every three CRNAs and two hospitals had one anesthesiologist for every four CRNAs. The staffing patterns did not appear to be

a function of case mix since the tertiary care facility had one anesthesiologist for every three CRNAs. Instead, program differences, historical precedent, future expansion plans, and philosophies of the chief anesthesiologists seemed to account for the variation in anesthesia provider mix. Nevertheless, despite the plentiful supply of anesthesiologists in California, the Kaiser System does employ a relatively large number of CRNAs.

Given the results of this study, it is impossible to identify an optimal mix of anesthesia providers, if one exists at all. On the other hand, there is no indication from a quality of care perspective that the current use of CRNAs should not be encouraged to continue, and financial considerations would certainly support the continued use of lower cost CRNAs. However, selection of anesthesia providers at each institution and for each surgical procedure should remain the responsibility of the individual facilities and their medical staffs.

Of the four generic payment options, inclusion of CRNA costs in hospital DRG rates while permitting anesthesiologists to continue billing Medicare directly has already been shown to discourage the use of CRNAs during the first year of Medicare's PPS. While some anesthesiologists would hire CRNAs, the overall effect would be a net increase in Medicare's payments for anesthesia services.

Continuation of the Part A CRNA pass-through to hospitals or the planned extension of direct billing privileges to CRNAs would have little impact upon current trends in the delivery of anesthesia services. While these payment options would not discourage the use of CRNAs, neither would their use be encouraged.

While the direct billing provision will provide CRNAs with the satisfaction of being financially independent, neither the pass-through nor the direct billing option will encourage better productivity or efficiency in hospitals. Given the relative increase in the supply of anesthesiologists combined with the competitive pressures on hospitals to enhance services, anesthesiologists, over time, would assume a relatively greater role in the delivery of anesthesia services with the resultant increase in costs to the Medicare program. However, as previously noted, the CRNA direct billing provision would increase both Medicare's program administration costs and the amount of beneficiary cost sharing.

An anesthesia DRG rate would have the potential for curtailing the rise in Medicare costs by controlling the rates paid for anesthesia services, but the impact upon the competitive position of CRNAs would depend upon the person or organization to whom such payments were made. It should be noted that the optimal model for encouraging the continued use of CRNAs may not be the most feasible when considering the implementation of anesthesia or RAP DRGs. From the CRNAs perspective, anesthesia DRG payments made to the hospital would definitely insure hospital employment opportunities and enhance the CRNAs competitive position. Relatively lower DRG payments made to anesthesia providers may encourage more anesthesiologists to hire or use CRNAs, but the extent of that outcome would be a function of the payment level combined with the supply of anesthesiologists in the region.

As the Kaiser case study has shown, many hospitals will continue to recruit anesthesiologists over CRNAs regardless of cost. In addition, with the increasing supply of anesthesiologists in the U.S. relative to the supply of CRNAs, the trend

of greater roles for anesthesiologists in the delivery of anesthesia services would appear to continue. The current Part A CRNA pass-through and the subsequent CRNA direct billing provision will not discourage the use of CRNAs by hospitals. However, an anesthesia DRG payment system may be a feasible means of curtailing the rate of increase in Medicare's payments for anesthesia services and possibly strengthening the CRNAs' competitive position.

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FINANCING AND DELIVERY OF ANESTHESIA SERVICES IN THE SOUTHERN CALIFORNIA-KAISER PERMANENTE MEDICAL CARE PROGRAM: A CASE STUDY

Introduction

The dominant mode of practice for anesthesiologists (MDAs) in the U.S. is self-employment in a solo or group practice with payment on a fee-for-service basis. Certified Registered Nurse Anesthetists (CRNAs) are most commonly employed by hospitals or physician practice groups on a salaried basis. The fee-for-service sector does not provide explicit incentives for using the appropriate, least-cost provider of anesthesia services because reimbursement is based on costs or charges. We hypothesized, therefore, that not enough CRNA services would be used in the fee-for-service sector.

Thus, as part of our study of "Payment Options for Non-physician Anesthetists Under PPS," the Center for Health Economics Research (CHER) conducted a case study of one prepaid medical care system, the Southern California Kaiser Permanente Medical Care Program. As a Health Maintenance Organization (HMO), with a fixed budget based on per capita enrollment, the Kaiser system faces economic incentives to operate efficiently, that is, to substitute lower cost non-physician personnel for physicians where possible. In theory, at least, the economic consequences of inefficient operation could be substantial. Overspending the annual budget would likely result in higher capitation rates for enrollees and a potential loss in Kaiser's position in a very competitive market in Southern California.

We were particularly interested in studying a system with a reputation for high quality care. The Kaiser system has a longstanding reputation for delivering quality care. The military sector or Veterans' Administration--two settings that make extensive use of non-physician anesthetists--are considered by many to provide "second-class" medicine and would not be acceptable to the mainstream.

The site visit to Kaiser's facilities in Southern California was conducted by Dr. Margo L. Rosenbach, a Co-Investigator on the CHER study, on November 17-19, 1986. Section 6.2 describes the methods used, Section 6.3 presents the findings, and Section 6.4 discusses the implications for the CHER study.

6.2 Methods

Entree to the Kaiser Permanente program in Southern California was provided by Dr. Carol Franklin, Chief of Anesthesia at the West Los Angeles facility and Chief of the Anesthesia Chiefs in the Southern California region. Dr. Franklin is a member of CHER's Technical Advisory Panel.

Appointments were arranged prior to arrival in Los Angeles. The schedule is shown in Table A-1. Most interviews were conducted at the West Los Angeles facility, although two meetings took place at the Regional Administrative Offices at Walnut Center, Pasadena, and a third meeting occurred at the Kaiser School of Anesthesia for Nurses in Los Angeles.

Dr. Sharon Conrow, Director of Clinical Services for Southern California Permanente Medical Group, was instrumental in arranging the two interviews at the regional office. Prior to the site visit, Dr. Conrow provided background information on the budget process, specifically as it affects the employment of non-physician personnel.

A long distance telephone interview was conducted with the Anesthesia Chief at the Anaheim facility, Dr. James DeFontes, on Thursday, November 20, 1986 and continuing the following day. Dr. DeFontes was unable to attend the Chiefs' meeting on November 18th, but because his anesthesia department differs from that in other hospitals, a telephone interview was conducted.

The findings presented in this report are not attributed to specific individuals, to assure the confidentiality of the interviews.

6.3 Findings

6.3.1 Overview

By way of background, the Kaiser Permanente system in Southern California had 1.8 million enrollees as of December 1984 (Interstudy, 1985). It is, by far, the largest HMO in the Los Angeles-Long Beach region. The plan was founded in 1946 and is organized as a group model HMO (that is, an HMO that contracts with one independent group practice to provide health

TABLE A-1

Schedule of Appointments: Kaiser Site Visit

Monday, November 17, 1986		
9:30 a.m.	Dr. Carol Franklin	Chief of Anesthesia, West Los Angeles Hospital
10:00 a.m.	Mr. Leonard Newman	Medical Group Administrator, West Los Angeles Hospital
2:00 p.m.	Mr. John Ruml	Director, Benefit/Cost Analysis
	Ms. D'On Voelcke	Analyst, Benefit/Cost Analysis, Kaiser Permanente Medical Care Program, Pasadena
3:00 p.m.	Ms. Adrienne Fishler	Regional Coordinator, Quality Assurance Program
	Dr. Gene Boruk	Director, Quality Assurance, Research, and Education; Southern California Permanente Medical Group, Pasadena
Tuesday, November 18, 1986		
10:00 a.m.	CRNA Supervisors	
	Ms. Linda Landhuis	West Los Angeles
	Mr. Jim Huber	Sunset
	Mr. Frank Perez	Woodland Hills
	Ms. Rachel Gilliland	Fontana
12:00 p.m.	Lunch with CRNA Supervisors and Anesthesia Chiefs	
1:00 p.m.	Anesthesia Chiefs	
	Dr. Carol Franklin	West Los Angeles
	Dr. Jack Goldin	Woodland Hills
Wednesday, November 19, 1986		
9:00 a.m.	Ms. Joyce Kelley	Director, School of Anesthesia for Nurses; Kaiser Permanente Medical Care Program, Los Angeles

services). Members average 3.2 physician encounters annually and 439 hospital days per 1000 members (Interstudy, 1985). For purposes of comparison, the Northern California region had 1.9 million members, averaging 3.4 physician encounters per member and 361 hospital days per 1000 members (Interstudy, 1985).

Within the Southern California system there are nine main facilities:

- Anaheim -- Orange County
- Bellflower -- Los Angeles County
- Fontana -- San Bernardino
- Harbor City -- Los Angeles County
- Panorama City -- Los Angeles County
- San Diego -- San Diego County
- Sunset -- Los Angeles County
- West Los Angeles -- Los Angeles County
- Woodland Hills -- Los Angeles County.

The Woodland Hills facility is the newest of the nine facilities, having opened in 1985. Based on data from the 1984 AHA Survey of Hospitals we developed a profile of the remaining eight hospitals. The occupancy rate ranged from 76.4 percent (Sunset) to 91.6 percent (Anaheim), well above the average for all hospitals in the Pacific region. As might be expected, average length of stay was well below the regional average, ranging from 4.6 days in San Diego to 6.2 days in Harbor City. The elderly (over age 65) account for between one-fifth (Bellflower) and one-half (Anaheim) of the total hospital days. At Sunset, the tertiary care facility, the over-65 population represents about one-third of all days.

6.3.2 Organization of Anesthesia Services

The Anesthesia Department in each facility is comprised of both anesthesiologists and CRNAs, although the degree to which CRNAs are utilized relative to anesthesiologists varies across areas. The anesthesiologists who

work at Kaiser are all specially screened to be sure they can work with CRNAs. Table A-2 shows the anesthesia personnel in each facility, along with the number of beds, anesthetizing locations, and cases per year.

Sunset, the tertiary care facility with 630 beds and 28 anesthetizing locations*, has 15 anesthesiologists and 47 CRNAs (roughly a 1:3 ratio). This is in marked contrast to Anaheim, a facility with one-third the number of beds (210) and one-fourth the number of anesthetizing locations (7), but a very different staffing arrangement. Anaheim has 7 staff and 11 per diem anesthesiologists and 9 staff and 3 per diem CRNAs.

The facilities roughly fall into four categories, corresponding to the ratio of anesthesiologists to CRNAs:

1 MDA:1 CRNA	Anaheim
1 MDA:2 CRNAs	Bellflower, Fontana
1 MDA:3 CRNAs	Panorama City, Sunset, West Los Angeles, Woodland Hills
1 MDA:4 CRNAs	Harbor City, San Diego

It should be noted that these ratios do not represent supervision ratios; some facilities may have one anesthesiologist for every two or three locations during the day, but no coverage (other than on-call) at night.

Such wide variation might come as a surprise in a system that is expected to foster efficient operation, and hence, maximize the substitution of lower-cost, non-physician personnel for physicians. Thus, we sought to discover what explains the wide variation in staffing patterns. Four factors were consistently mentioned:

- Program differences;
- Historical precedent;
- Future expansion; and
- Philosophy.

One important difference among facilities is whether they have 24-hour (in-house) coverage by an anesthesiologist. Four facilities currently have

*Anesthetizing locations include, for example, surgical operating rooms, the obstetric area where epidurals are performed, radiology, and cysto rooms.

TABLE A-2

CHARACTERISTICS OF FACILITIES IN THE SOUTHERN CALIFORNIA KAISER SYSTEM

Facility	Number of MDAs*	Number of CRNAs*	Number of Beds	Number of Anesthetizing Locations	Number of Cases/Year
Anaheim	18	12	210	7	6,700
Bellflower	9	17	342	15	12,000
Fontana	11	25	375	14	13,800
Harbor City	4	14.4	230	10	6,600
Panorama City	7	22.6	321	14	7,800
San Diego	9	31.2	300	15	12,000
Sunset	15	47	630	28	13,000
West Los Angeles	5	20.8	212	13	8,000
Woodland Hills	3	16	150	8	5,160

*Includes per diem personnel.

such coverage--Anaheim, Bellflower, Fontana and Panorama City--as part of a pilot program to provide epidurals during labor and delivery. The West Los Angeles facility relies primarily on CRNAs for after-hours anesthesia. One CRNA is in-house 24 hours to take "first call." Another CRNA on "second call," is available on an as-needed basis but is not in the hospital. At all times, an anesthesiologist is available to provide back-up. Expansion to 24-hour coverage in a facility such as West Los Angeles or Woodland Hills would require doubling the number of anesthesiologists on staff, for a total of eight to ten anesthesiologists.

A second factor is historical precedent. When the Kaiser Foundation Hospitals purchased the Anaheim facility, it was a private non-profit hospital that relied primarily on anesthesiologists. Despite the addition of CRNAs to the staff, the facility has continued to rely mostly on anesthesiologists.

Another explanation for the disparity between Anaheim and other facilities is the intent to build a new tertiary care facility in Orange County (Garden Grove) that would draw on the anesthesia staff at Anaheim. The Chief at Anaheim, therefore, has expanded the physician staff to meet this long-term (1990) need.

Another factor is philosophy towards CRNAs. At some facilities, the CRNAs give most of the anesthesia, while the MDAs perform pre-anesthetic and post-operative evaluations. In such facilities, the anesthesiologists rarely provide direct anesthesia care. Even on some of the most complicated cases, the CRNAs function with minimal supervision. In other facilities, anesthesiologists work in a room on a regular basis, "to keep up their skills." In part, such philosphical differences account for the wide variation in the MDA/CRNA ratio between Anaheim and the tertiary care facility at Sunset. In all facilities, however, a universal philosophy exists regarding regional anesthesia--only an anesthesiologist may administer regional anesthesia.*

*This is currently a controversial topic because some CRNAs wish to perform regional anesthesia. Up until recently, California state law prohibited the administration of regional anesthesia by CRNAs. A recent legal interpretation now allows CRNAs to perform regional anesthesia. The Anesthesia Chiefs in the Kaiser-Southern California system have not achieved consensus on the use of CRNAs for regional anesthesia. It is expected that individual decisions will be made by the Anesthesia Chiefs for their own facility.

The differences in MDA/CRNA use across facilities may be highlighted through several illustrations. Take, for example, a 70 year old patient with a gallbladder problem who is being admitted for a cholecystectomy. The patient comes to the hospital the day prior to surgery for a pre-operative evaluation. The evaluation would be conducted by an anesthesiologist in most facilities, although one facility does use CRNAs for pre-ops. On the day of the surgery, the patient is admitted to the hospital (A.M. admit). The CRNA reviews the chart (including the pre-operative evaluation) and then interviews the patient and explains the anesthetic technique. Next, the CRNA confers with the MDA supervisor about the anesthesia care plan. Once in the operating room, the CRNA prepares the patient for surgery and calls the MDA supervisor when induction is ready to begin. The supervisor may or may not be present during induction, depending on what is happening in other rooms and depending on the supervisor's confidence in the CRNA. Following induction, the supervisor might make rounds or else might be involved in pre-operative evaluations for the next day's surgeries. Again, during emergence, the supervisor might or might not be present. Due to the philosophical orientation of the Anaheim Chief and his staff, the CRNAs in Anaheim are more closely supervised than in other facilities.

Following surgery, the patient is moved to the recovery room. At some hospitals, only the anesthesiologist can discharge the patient from the recovery room. In others, the CRNA can sign the patient out if there are no major problems, based on a "ready-scoring" system. At one facility, surgeons run the recovery room and most post-anesthesia evaluation is performed by recovery room nurses rather than anesthesiologists or nurse anesthetists.

For a craniectomy, performed at the Sunset tertiary care facility, one MDA supervises one CRNA, given the complexity of the surgery and the anesthesia. Nevertheless, the degree of supervision depends on the supervisor's confidence in the CRNA. Invasive monitoring devices (i.e., CVP line, Swan Ganz catheter) are inserted by the anesthesiologist in the pre-op holding area. The CRNA inserts the arterial line. The CRNA usually requires assistance (i.e., another pair of hands) prior to induction with positioning the patient and inserting the "drips." Generally the anesthesiologist will

assist with these preparations and be present for induction. The anesthesiologist often leaves the room after induction although the CRNA will call the supervisor if an adverse event occurs such as hypotension or hypertension. In addition, the supervisor usually stops in on occasion to check the status of the patient.

How can inter-facility differences exist in a fixed budget system like the Kaiser system? We turn next to a description of the budget process.

6.3.3 The Budget Process

The Kaiser system in Southern California (as in other regions) involves three organizational entities: the Kaiser Permanente Health Plan, the Kaiser Foundation Hospitals, and the Southern California Permanente Medical Group. The Health Plan annually contracts with the hospitals and medical group to provide a specified set of benefits to its member population. Based on the cost of the negotiated contracts, the Health Plan sets a per capita membership rate. Enrollees join the Health Plan and are assigned a medical facility on the basis of zip code. However, enrollees may choose an alternate facility, if they desire.

The Southern California Permanente Medical Group (SCPMG) is a partnership of physicians. The physicians are paid on a salaried basis with an incentive compensation based on group performance. (The "compensation" can be either positive or negative depending on whether SCPMG overspent or underspent its budget. The payment is typically very small, relative to other compensation arrangements.) The partnership is self-insured for malpractice liability, another form of compensation for partners and their employees.

When a physician is hired by SCPMG, he or she works for two years as an employee of the partnership. Towards the end of the second year, the department chief and area medical director discuss whether the physician should be admitted to the partnership. If so, the physician is nominated to be a partner and a vote is taken among all partners in the area.

The Medical Group also employs ancillary personnel, including the nurse anesthetists. In Southern California, the CRNAs are unionized and are the highest paid non-physician employees of SCPMG.

In general, allocation of physicians (all specialties) is based on a ratio of one MD per 880 enrollees. (Adjustments are made for the age and sex composition and utilization history of the enrollee population.) In addition, for every physician, three non-physicians personnel are budgeted. Thus, there are two bottom lines, one for physicians and one for non-physicians.

At the area level, administrators are not in a "dollar-budgeting" mode. In other words, budgeting is based on simple FTEs, rather than the actual cost of those FTEs. The assumption is that within the two personnel categories (physicians and ancillaries), the variation in salaries is not significant. The calculation of FTEs is based on number of hours worked and does not differentiate overtime hours (paid at time and one-half) from a straight shift.

As a partnership, the Permanente Medical Group accepts only full-time physicians to be full partners or working towards partnership. When a department is understaffed, staff physicians can work overtime or the Medical Group can contract out for "per diem" physicians. (Per diem physicians are typically moonlighters from private practice or academic health centers.) The contracting option is very costly, however. Kaiser wages average $40 per hour, compared to "per diem" wages of $100 per hour. A third option, that is more costly still, is to contract with an anesthesia service, known as the Spring Group. This option was used to staff the Woodland Hills facility when it first opened.

There are apparently two ways to accommodate a request for additional physicians, in this case, more anesthesiologists. One approach is to renegotiate the physician-membership ratio. Alternatively, internal "reshuffling" could take place, by examining other physician specialties that could be cut back (perhaps as a result of attrition or changes in membership composition). For example, the medical director and medical group administrator at a given facility (in consultation with members of the medical group) might reduce the pediatrics staff by one physician and substitute a nurse practitioner or registered nurse for routine care in order to hire an additional anesthesiologist.

The budget cycle runs from March to September or October of each year. In March, the regional office sets the rate for the following year. The rates must be set early in the year to provide membership groups (employers) adequate notice for their own budget cycles. Concurrently, each facility develops a budget for personnel (FTEs), capital, and other expenses. This budget is based on the previous years' figures adjusted for anticipated growth and new projects. The facility budgets are submitted to the regional office and assembled for the entire region. The regional office and the individual facilities negotiate for several months until they arrive at an area-level bottom line estimate that is consistent with the rates set earlier in the year. In September or October each facility receives operational FTEs and projected membership for the following fiscal year.

6.3.4 Monitoring and Evaluation

Two efforts are currently underway to assess the personnel needs of the Anesthesia Departments in the Southern California region. The first is a cost-benefit analysis of CRNA use relative to anesthesiologist use. This study is being conducted by the Kaiser Permanente Medical Care Program,* and is currently in the research design phase. It would appear that one of the research goals is to determine an appropriate ratio of MDAs to CRNAs, taking into account the costs of the two providers as well as the nature of their respective roles.

On a very preliminary level the analysts have found that two CRNAs cost roughly the same as one MDA. However, the analysts have not yet determined where the substitutability lies and whether two CRNAs and one MDA together are more productive than two MDAs, in performing the full range of anesthesia-related activities.

*The Kaiser Permanente Medical Care Program is the entity that contracts with the Kaiser Foundation Hospitals and Permanente Medical Group. As such, this study is being conducted by an organization that is separate from the hospitals and the medical group.

As a first step, the analysts have used regression analysis to examine whether the cost of anesthesia services varies directly as a function of the MDA/CRNA ratio, controlling for volume or hours, and surgical mix. Costs were not found to vary directly with the MDA/CRNA ratio.

To better understand the variations in anesthesia service delivery that might have a bearing on costs, the analysts have begun an investigation of the patterns of care among hospitals. In one hospital with the pilot epidural program, for example, one anesthesiologist is solely responsible for inserting epidurals and monitoring the patient for one-half hour. Then an OB nurse takes over the monitoring. In another hospital the anesthesiologist inserts the epidural but a CRNA performs the monitoring.

A distinctly separate effort is being undertaken by the Southern California Permanente Medical Group, known as the Anesthesia Services Survey. The survey had the following goals and objectives:

- to assess each Medical Center's compliance with JCAH and Title 22 standards;
- to measure each Medical Center's services against community standards and current professional practice;
- to identify those standards beyond state requirements that should be achieved by each Medical Center;
- to gather information about practices within Kaiser Permanente Medical Center's Anesthesia Departments that can be shared by the various chiefs; and
- to help each Medical Center in the Southern California Region provide the highest quality of care possible.

The instrument contains three parts, outlined in Exhibit A-1: Departmental Organization, Safety and Equipment, and Postanesthesia Care Unit. The instrument was distributed to each Chief of Anesthesia about one and one-half to two months prior to the onsite visit. The form was to be completed at least two weeks before the site team visited to enable the team members to review the information. The on-site meeting included interviews with the Chief of Anesthesia, CRNA Supervisor, Quality Assurance Coordinator, and Postanesthesia Care Unit Supervisor.

ANESTHESIA SERVICES SURVEY

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The site visits were completed in early Fall. Written reports have not yet been prepared. The survey team intends to write an area specific report, summarizing the Task Force findings about each facility. Next, a region-wide report will be drafted, integrating the findings across facilities. Then, recommendations will be made by the Task Force and action plans will be developed by each Medical Center to implement the recommendations. The Task Force will ensure that the action plan is being carried out, during the yearly in-house survey in subsequent years.

Among the recommendations that could emanate from the Anesthesia Services Survey are the following:

- change the ratio of MDAs to CRNAs in some hospitals
- extend 24-hour MDA coverage to more hospitals
- increase the role of MDAs in administering anesthesia
- give the Anesthesia Department administrative authority over and medical direction of the Postanesthesia Care Unit and the Same-Day Admit Unit
- establish uniform proctoring policies for CRNAs, with proctoring by anesthesiologists, not CRNAs
- expand proctoring for anesthesiologists, not just in supervising CRNAs, but also in administering anesthesia
- expand the availability of invasive monitoring techniques
- require Advance Cardiac Life Support (ACLS) certification for all Postanesthesia Care Unit and Anesthesia personnel.

Of course, the recommendations will be site-specific, based on the Task Force findings in the survey.

6.3.5 The Nurse Anesthesia School

The Kaiser Permanente Health Plan operates a nurse anesthesia training program in Los Angeles. The school provides an important resource to the Anesthesia Departments, in terms of "extra hands" when the students enter

their senior year, as well as a hiring ground for their staffs. An estimated 80 percent of the students stay in the Kaiser system after graduation, most in the Southern California region.

Founded in 1972, the school now grants a Master of Science Degree in Nursing, Clinical Specialist in Anesthesiologist. The program, conducted in conjunction with California State University at Long Beach, runs for 24 months and includes classroom sessions, clinical assignments, a research thesis, and comprehensive final examination. At least 310 clinical days (2,480 hours) must be completed prior to graduation, for various types of surgery and types of anesthetic techniques.

During the first semester, the student nurse anesthetist is assigned to a facility and works with a clinical instructor. The student spends two days per week in the clinical setting, learning about the equipment and about the role of the CRNA "at the head of the table." The students rotate through most facilities in Southern California, excluding Anaheim and Harbor City. During the second semester, the student spends four days per week at the facility and becomes more involved in direct anesthesia care. The clinical instructor (a CRNA) is present at all times and can step in, particularly if the pace is slowed by the student. During the last three months of training, students are assigned to their own rooms and are supervised by an anesthesiologist.

The budget impact on the individual facilities is minimal. Clinical coordinators in each facility perform the scheduling and are paid a nominal amount for their added responsibility. (These funds come from a special account set aside for "community services," such as education.) The clinical training does not require extra personnel and, in fact, during the last semester student nurse anesthetists are working in their own rooms.

6.4 Discussion

In this case study of the Kaiser system in Southern California we set out to learn first, how CRNAs are used in an HMO setting, and second, how the budget process of a prepaid system provides incentives for substituting CRNAs for anesthesiologists. What we learned is that the use of CRNAs varies widely

across facilities and this may be a function of program differences, future expansion plans, historical precedent, and philosophical differences. However, across all facilities there is a distinct trend towards expanding the role of anesthesiologists: in directly performing clinical anesthesia (vs. supervising CRNAs), in providing 24-hour in-house coverage, and in more closely supervising CRNAs (based on a 2:1 ratio). Of particular note was the marked contrast in the use of anesthesiologists versus nurse anesthetists (in both absolute and relative terms) in the tertiary care facility at Sunset compared to the Anaheim facility. In particular, the lack of 24-hour in-house coverage by an anesthesiologist at the tertiary facility was an unexpected finding.

What we are likely to see in the Kaiser system over the next five years mirrors the trends in the fee-for-service sector. Anesthesiologists will undoubtedly take over some responsibilities previously delegated to CRNAs such as night and week-end coverage and clinical anesthesia services. Increased delivery of clinical anesthesia services by anesthesiologists would enable them to maintain their skills and ostensibly make them better supervisors. The rationale for 24-hour in-house coverage by anesthesiologists is twofold: first, it removes the "double standard" of having anesthesiologist supervision during the day for scheduled cases but not during the night or on week-ends (except via on-call) for emergency cases; second, as long as CRNAs are prohibited from inserting epidurals, 24-hour coverage by an anesthesiologist will ensure the availability of this service for obstetric patients.

What are the forces that make these trends likely? First and foremost is the increasing supply of physicians generally, but particularly anesthesiologists. Physicians finishing residencies find the HMO option more attractive than they previously did, especially as private practice options dwindle and as starting salaries in the fee-for-service sector begin to approach HMO salaries. The Kaiser Permanente 1985 Annual Report (p.14) cites evidence from a 1985 survey indicating that physicians are now more favorably inclined towards participating in HMOs than just four years earlier.

In a 1985 Harris poll prepared for The Henry J. Kaiser Family Foundation, 46 percent of the non-HMO physicians surveyed said they were considering an HMO career, while in 1981, only 27 percent were considering the option. Furthermore, once they try practicing with an HMO, most physicians seem to like it. Harris found high levels of satisfaction with prepaid practice: 86 percent of the surveyed group practice prepayment physicians and 78 percent of IPA physicians plan to continue prepaid practice.

Another force motivating the increased use of anesthesiologists relative to CRNAs is a belief that not enough anesthesiologist input was provided in some cases. With the increasing availability of residency-trained anesthesiologists, CRNAs may be supervised more closely and better coverage of the recovery room is possible.

What do these trends portend for the use of CRNAs in Kaiser facilities? Inevitably, with the increasing role of anesthesiologists in clinical anesthesia, slightly less CRNA input would be required (perhaps 1-2 rooms fewer per day). Nevertheless, CRNAs would continue to cover the remaining anesthetizing locations, but with closer physician supervision. The addition of 24-hour in-house coverage by an anesthesiologist could reduce the need for on-call by CRNAs. Thus, from a budgetary perspective, increasing the role of anesthesiologists does not appreciably change the number of CRNAs utilized but greatly increases the number of anesthesiologists. The budgetary process can accommodate these increased "demands" for anesthesiologists in one of two ways. The no-cost solution is to reallocate specialty slots within the Medical Group to allow for the employment of additional anesthesiologists. This would have to be accomplished within the constraints of the physician-membership ratio set by the Kaiser Foundation Health Plan. The other solution is to renegotiate the physician-membership ratio, to account for additional anesthesiologists. This would raise the capitation rate set by the Kaiser Foundation Health Plan.

In any event, the Kaiser system in Southern California appears to be in a transitional phase with regard to anesthesia service delivery. CRNAs are, and will continue to be, the principal providers of clinical anesthesia services. But the role of anesthesiologists seems to be increasing. Not only

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